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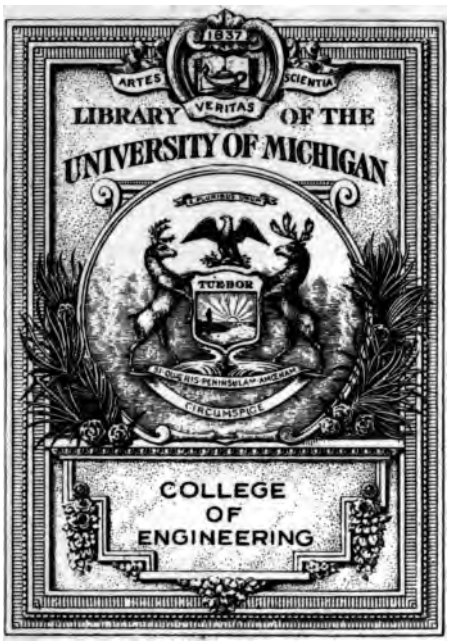
Tire Making and Merchandising

F. R. Goodell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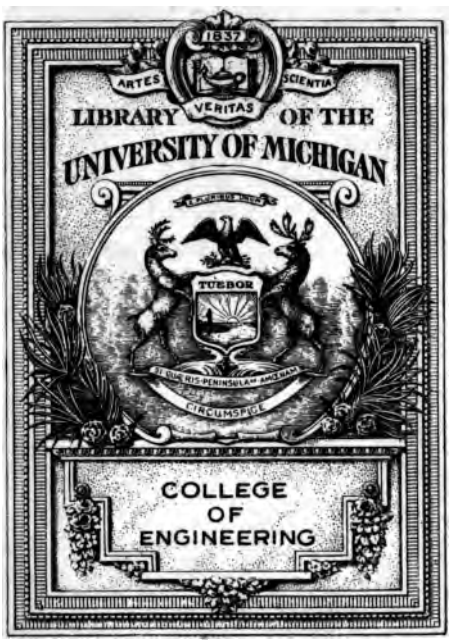
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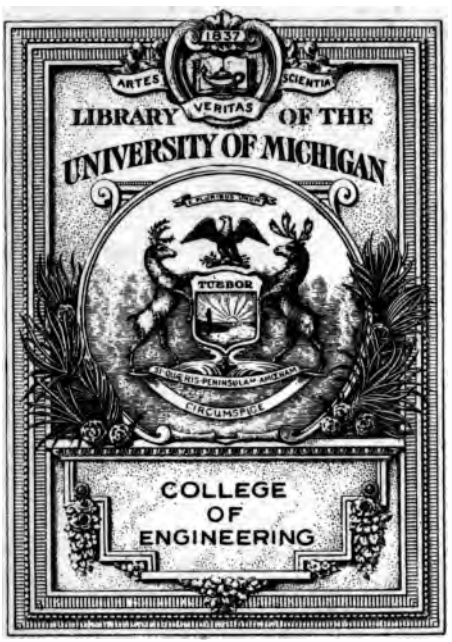
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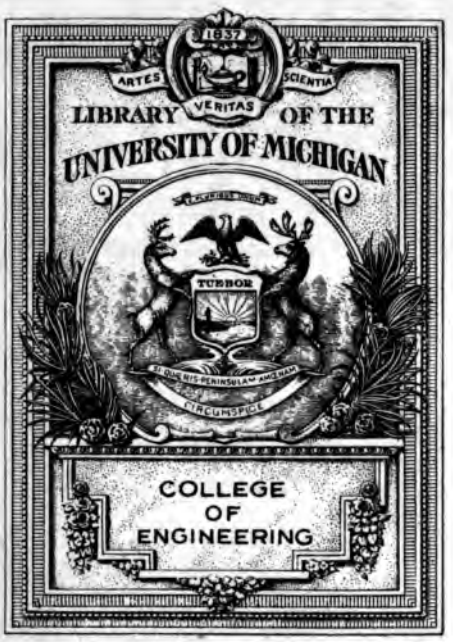
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TIRE MAKING *and* MERCHANDISING

By F. R. GOODELL
Converse Rubber Shoe Company

A Book of Facts Concerning Manufacturing Processes, Illustrating the Principle Tire Types, Rims and Non-skid Treads, with Chapters on Rubber and Other Factors Governing Tire Costs, Present and Future Trend of the Market, Merchandising for Profit, Dividends from Service, Marketing Methods and Sales Campaigns, Tire Equipment of All Pleasure and Commercial Cars from 1913 to Present Date, and a Dealers' Dictionary of Terms.

NEW YORK
U. P. C. BOOK COMPANY
243-249 West Thirty-ninth Street
1918

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PREFACE

The rubber tire made the automobile practical. Without it no passenger car regardless of metal spring arrangements would be comfortable and the motor truck would be less enduring.

The demand for tires is a steadily increasing one; the war while restricting the output of passenger cars, has made but slight inroads on tire consumption. In the past, the dealer's greatest problem was not how to sell tires, but how to get enough to meet demands. Manufacturers increased their factories time and again until some of them became miniature cities, and still the demand could not be filled.

As in all new industries, manufacturing and selling costs were high, wholesale and retail selling prices were well maintained, and any one who conducted the business with sufficient capital and with good judgment was rewarded with an ample profit.

Now conditions are changing; the supply equals the demand. The automobile trade as it is growing older is becoming better established; it has now some trade traditions and customs to live up to; it is recognizing the laws of business and of commerce which were ignored in its formative stage. The same can be said of the tire industry. Both are getting down to the practical business; they are backing up their products by faithful guarantees, they are making products that will give service and build reputations. The idea of making something just to sell has long since been cast aside.

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The time is not so far distant, unless the war brings in causes that will change the natural order of things, when automobiles and rubber tires will be sold on standard lines much as bicycles are to-day. Then so much material and so much labor added to the known good will of the manufacturer will produce an article that is worth a given amount. When this happens there will open an era of shorter profits, but the business will be on a solid and sure foundation that will be attractive to business men of the highest caliber.

The author has endeavored to supply a needed want; he has told plainly of some of the difficulties that are experienced by tire dealers; he has also advised how they can be overcome. He has taken pains to gather and place in compact form the information on making, marketing and merchandising that the progressive business man should have in order to make a success in the tire business.

That the field is a broad and an inviting one is beyond all question. It is so new that a few have learned its intricacies and its real possibilities for investment and return. Its permanency should prove attractive, for tires will be sold as long as automobiles run or airplanes fly.

The author acknowledges his indebtedness for information and figures to the "Tire Rate Book," *Hardware Age, Automotive Industries, Indian Rubber World, The Automobile Motor World, Rubber Age and Tire News, New York Tribune,* B. F. Goodrich Co., Converse Rubber Shoe Co., Goodyear Tire and Rubber Co., Quaker City Rubber Co., United States Tire Co., Wayne Oil Tank and Pump Co.

CONTENTS

CHAPTER PAGE

I THE TIRE GAME 7

The "Foreign Devil" auto—The Beginnings of the Auto industry—Henry Ford's obscure shop—Troubles of the tire maker and owner—Growth of the automobile industry—National car and truck registration, 1903 to 1917.

II WHAT RUBBER IS 13

Importance of rubber—Rubber itself—A tread compound—Wild rubber—The hevea tree—Plantation developments—Tapping—Coagulating the latex—Just as good as rubber?—Simple Simon and his synthetic rubber—The German chemist—Gilding the lily—Future of the gum—An assured supply—Reasonable prices expected.

III DEVELOPMENT OF TIRE MAKING 29

Pneumatic tire made modern automobile possible—Early tire types—Rim fundamentals—The clincher—Q D or quick detachable—Straight side—Universal rim—In a nutshell—Clearing up the dead wood—The "Oversize" formula—The plot thickens—Exceptions—Best selling sizes and why—Future tendencies.

IV MANUFACTURING MILEAGE 42

Early developments—Washing—Compounding—Fabric—Calendering—Fabric cutting—The tire itself—The tread—Breaker strip and cushion—Fabric plies—The side walls—The bead—Carcass assembly—Unit molded cure Pro and con—Combination or double cure—Bead assembly—"Curing," a storm center—Unit wrapped cure—Summing up—A word on tubes.

V MANUFACTURING SLANTS AND ANGLES . . 59

Other manufacturing differences—What balance means—With brains, sir—Hand versus machine made—Cord or Fabric—Cord versus cord—A word on non-skids—The perfect non-skid—Evolution of a non-skid design—A vast laboratory—Some non-skid types—Summing up.

CHAPTER PAGE

VI ANALYSING TIRE COSTS 74

Distribution of materials—Distribution of cost items —Comparative fluctuations—Rendering unto Cæsar.

VII MERCHANDISING TIRES FOR PROFIT . . . 81

Just merchandise, that's all—Getting down to cases— What does the public want?—Protecting profits—Fallacy of price limits—How it works out—A prophecy—Getting started—What is profit?—A live sermon on tire profits —The answer—"Seconds and Gyp" tires—The higher balance—Consumers hold the whip—How it works out— Keeping stock—Tagging tires for stock—Cash discounts.

VIII MARKETING METHODS 105

"Getting them coming"—The scenario of success—The mailing list—Sizing up competition—The store front— Putting the window to work—Inside hints—Price tagging —Imagination and resource—Getting the most out of mailing lists—Winter business—Utilizing the ill wind— Selling the Ford owner—Advertising angles—Service and how to give it.

IX ADJUSTMENTS 135

Great expectations—Causes precede effect—Post mortems —Wasting $150,000,000—Putting the just in adjustments—Saving air and wasting dollars—From the "Tire Morgue"—Under-inflation—Stone bruise—Faulty wheel alignment—Neglected cuts—What brakes do—Chain binding—Rut and car track driving—Rim cutting and bead trouble—On guarantees—How the adjuster works.

X "TIRE LINGO" 162

A dealer's dictionary of terms and phrases used in the production and sale of tires.

XI VALUABLE TABLES AND STATISTICS . . . 169

Statistics and how to use them—Tire equipment of principal makes of pleasure cars 1915 to 1918—Index of tire sizes—Distribution of tire production as to rim types 1916–17—Notes on ordering—Car and truck registration by states during 1916—Registration in proportion to population—The distributing medium—Who's Who in Tiredom.

TIRE MAKING AND MERCHANDISING

CHAPTER I

The Tire Game

Do you recall the first automobile you ever saw? We had one in our town when the Spanish-American War broke out—it was a Foreign Devil owned by the worthless son of our only millionaire. You could hear it coming long before it hove in sight. It didn't have a horn and it didn't need one for it advertised itself all over the country every time it ambled up Main Street. It seemed to be afflicted with asthma and general debility—its motion "in high" was barely perceptible and a Gipsy moth with ambition could have thwarted its whole purpose in life.

Those were the days when automobiles were "Horseless Carriages." Even the hardy pioneers referred to the enterprise as a "game," and it was the subject of mellow humour on the part of regular business men. Our local dealer was a hardware man in his sober moments, but he was a daredevil at heart. He worked off two cars his first year—and after that he was never the same. His demonstrating car boasted an engine rated 16 horsepower, but it was reputed on good authority that he could never get more than one horse working at a time, and *that* one usually had spavin and stringhalt. At

any rate his route for demonstrations was so arranged as to avoid even a suggestion of grade, and if he could force it to stagger out to the Country Club and back he was delirious with joy. After that came the era of steam cars that steered with a tiller. The boilers were placed cunningly under the seat so that the driver started out sitting down, but often returned standing up and not boasting of any icicles at that. It was about this time that solid tires were discarded for new fangled French and English pneumatics. This gave a great impetus to the industry—it really put the *mobile* into automobiles by vastly increasing speed and power. The tendency was still to make the car look as much as possible like a carriage, and the curved dash was considered a nifty piece of body designing.

Soon R. E. Olds, Winton and Packard entered the field, and in some obscure shop Henry Ford was pottering around while the neighbors were passing votes of sympathy to his family. Gradually the motors were made lighter—multiple cylinders did their part in lessening weight, carburetors were improved, differentials were devised, and with the first shaft-driven cars the automobile came into its own. The thing was gradually getting standardized and fool proof—in fact, the only wholly annoying feature left was the tire question. The average maker and owner had had so many real problems that the tire failed to receive serious consideration until the increasing speed and reliability of the car threw this item into sharp contrast. As a matter of fact almost any tire was a good tire up to the time when twenty miles an hour ceased to be remarkable. Very soon tires became the most exasperating problem a motorist had to solve—in fact, it is probable that even today the average tire is not as good as the average car—but it's largely the

motorist's fault. As long as he gave no real thought to the matter and contributed nothing to the industry but a demand for cheaper tires—his influence was inevitably depressing the quality of the product. It was a vicious circle wherein the factory could produce nothing better than the public would accept, and the public as a whole wanted tires built down to a price. But the situation has rapidly improved—veteran motorists have learned that no one can get out of a tire anything more than was built into it. They have become discriminating to a high degree and are willing to be shown at least that a higher price represents an investment rather than an expense. This more liberal view has encouraged the manufacturer to put (excuse a plain Americanism) more "Guts" in his tires and to *price* them in proportion to the bigger work they do. In very recent years a distinct market for premium-priced tires has been developed, and it is gratifying to note that it becomes larger and more clearly defined each year. The cheaper tires will always be in demand as well—many of them present a fine money's worth and in the case of light cars used only at intervals they sometimes offer the best possible purchase.

The automobile has become one of the great staple industries—raising itself from the level of an expensive luxury to a great world necessity within twenty years. The "saturation point" so much feared by calamity howlers has never developed. In 1910 it was estimated that the average annual increase of about 200,000 cars could not be bettered—might in fact drop off, but a glance at the chart shown in Fig. I shows that the "curve of increase" shows no tendency as yet to flatten out, in fact is increasing now at a rate of about one million cars per annum. The effect of this growth on the tire dealer is vast—in the year ending January 1, 1916, 2,400,000

cars were in use. Figuring a normal consumption of five tires per car each year, at an average selling price of $25.00, the national tire investment would be $300,000,000. But by January 1, 1917, one million additional cars were in use which with higher price schedules brought the nation's tire bill to well over one-half bil-

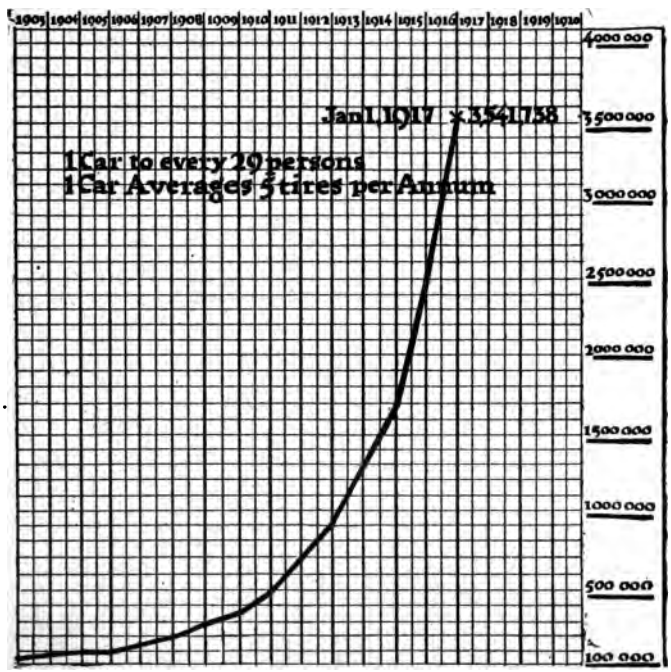


Fig. 1. National Car and Truck Registration from 1903 to 1917

lion dollars. Let us pause for a minute to find out just what these figures mean to the average dealer and his cash register. What may he expect from tires during this present year of 1917. We start with a total automobile registration (exclusive of trucks or bicycles) January 1, 1917, of about

3,500,000 cars
requiring an average of 5 tires per annum
or 17,500,000 tires
at average price $25.00
Making $437,500,000 gross business

which divided by approximately 40,000 dealers yields an

average dealer yearly tire business of.....$10,937.50
which at average working discount of.....20 per cent.

yields a dealer average gross profit of.....$ 2,187.50

These figures are intentionally conservative and do not take into account the 1,500,000 cars being turned out during this current year. These cars will be equipped with tires by the auto manufacturer and will represent an investment of about $100,000,000 figured at lowest prices to manufacturers. By the following year however, these cars will automatically boost the dealer's business for it is up to him to keep them shod.

Tires are easily the supreme accessory for they are really a running expense and are consumed and replaced like gasoline and oil. The demand for them is inevitable—in fact, many dealers are enjoying profits all out of proportion to the scanty time and thought devoted to the work in hand. There is coming a time, however, when the profits in the business will go to those dealers who know most about business principles in general and the tire business in particular.

In fact, the marvellous present and gorgeous future of the tire industry is drawing to it distributors of the highest calibre. It has indeed become essentially a business for *business men.* The hardware dealer has already entered the field as a very logical competitor and he is applying the same sound principles that have made his

class one of the solid pillars of American commerce. His participation as well as that of other "old line" groups will have a wholesome and clarifying effect on the enterprise. Many marketing abuses are being eliminated already and more of them will go where the "woodbine twineth" in short order.

CHAPTER II

What Rubber Is

Think of tires and you unconsciously think of rubber. Rubber made the modern tire a possibility and it is by all means the largest individual factor in its fabrication today. It is reasonable then to preface any consideration of tires with an inquiry as to the nature of rubber, its source and the methods by which it is brought to a state of commercial utility. Due to the fact that rubber constitutes at least 50 per cent. of the total mass weight of a tire, it has been customary to consider the price of crude rubber as a reliable barometer by which one could gauge the probable trend of tire prices. This, however, is hardly true of the present market as so many other factors, such as fabric, labor, drugs, overhead and sales expenses are reacting from the effects of the war. Fabric for instance which forms about 25 per cent. of the mass weight of a tire is now responsible for approximately half the factory cost of an average tire and will assume a still greater predominance as a cost factor if the war continues indefinitely.

Importance of Rubber

While the uses of rubber are well known it's nature and the processes used to make it available for commercial use are clouded in mystery. Rubber is one of the world's greatest vegetable products, vieing with cotton and wheat in commercial importance. The list of rubber products is a long and diversified one, for it is a necessity in every form of business activity. It is indeed a very versatile vegetable and ranges in use from pipe stems

and combs to tires, hose, steam packing, balloons, gloves, sponges, footwear and soles. The industry can be roughly classified into five major groups: Hard Rubber, Mechanical Sundries, Druggist Sundries, Tires, and Footwear. Figured in dollars and cents, tires will loom up as the most important, their value being approximately one-half of the whole amount.

Rubber Itself

There is a weed which grows freely in our climate and which the botanists have dolled up under the name of Asclepias. As a matter of fact it is nothing more or less than the lowly milkweed, and its sap or latex has all the properties of low grade rubber. Now if you should patiently collect one pound of this sap and add to it approximately

1 lb. of whiting
¾ of a lb. of litharge
1 oz. of lampblack
4 oz. of tar
3 ozs. of sulphur

you would have a compound comparing favorably with that used in a cheap grade of rubber footwear. In the above you will notice a large percentage of adulterants or "Drugs" but for the purposes it is intended, these ingredients are absolutely necessary and make a far better stock than if only bulk gum (latex) and sulphur were used. Pure rubber without tempering ingredients has practically no commercial use, and despite the claims of some manufacturers is as hard to find as ear muffs in Honolulu. From a chemical point of view, rubber blends readily with metallic oxides and sulphides and in so doing draws from each a new strength without any perceptible loss in elasticity. This fact is taken advantage of by some manufacturers who find it profitable to use an excess of drugs, with the result that the com-

pound is ballasted with useless and inert matter. This is of course not true of the product of those reliable companies who have a reputation to protect. Yet the percentage of drugs is of necessity considerable, ranging from 20 to 25 per cent. of the total weight of a tire and approximated 50 per cent. of the compound used to form the tread. To illustrate here is a formula for the compounding of a very tolerable tread of at least average quality.

A Tread Compound.

20.00 per cent. smoke sheet plantation rubber
20.00 per cent. Ceylon (First latex)
53.25 per cent. Zinc oxide
3.50 per cent. sulphur
2.00 per cent. Light magnesia
1.25 per cent. Organic accelerator

The proper compounding of rubber and its vulcanizing or cure, are processes requiring the highest degree of skill and years of experience. Until recently there has been no university so equipped as to offer instruction in this great science and the masters of the profession have learned their art wholly in the great school of practical experience. But to get back to what rubber is—there are innumerable trees, vines and shrubs whose sap contains the essential characteristics of rubber. Of these only the tree produces a sufficient quantity to be available for the severe requirements of the tire manufacturer. Of the several varieties of trees, it is above all the Hevea tree, native to the Amazon Valley, that rubberdom looks to for practically all its high grade gum. The gathering of this wild gum is interesting and worthy of a word or two. Imagine an immense jungle of hundreds of thousands of square miles of low and marshy land dominated by the mighty Amazon and its

tributaries. Here, in this dense growth of rank vegetation are countless forests of wild rubber trees—much of it so inaccessible as to be untouched.

Wild Rubber

Handicapped by floods, wild beasts, reptiles and fever, the native must penetrate this howling wilderness and bring from its depths a cargo of the precious gum. Having been

Fig. 2. A Plantation of Young Hevea Trees

staked to supplies by a middleman, the native works on a sort of fifty-fifty commission, disappears from headquarters at Para or Manaos and emerges weeks or possibly months later with his load. After getting out in the jungle, he first locates several hundred trees and establishes a route from tree to tree. (The number of trees being limited to what he can attend to each day.) The method of drawing off the sap from the Hevea tree

is somewhat similar to the process by which the maple is made to produce its wealth. A few gashes are made in the bark, and a little cup is so placed as to drain the cut. Day after day the native makes his route, cutting new gashes and slowly accumulating a supply of the latex. From time to time he builds a smoky fire of cocoa palm-nuts and dipping a paddle into the latex he holds it over the fire until the sticky mass coagulates. He repeats the process continually until he obtains a large "biscuit" of gum, which he cuts away from the paddle. Thus the rubber is made available for easy handling and finally reaches the manufacturer in this form, having passed from the gatherer to the city merchant at the shipping centers, and thence distributed throughout the world.

Rubber of a low grade is sometimes extracted from *vines* such as the African Grass rubber by crushing the entire growth through a Mill, thus squeezing out the latex, and rubber gum is also mechanically extracted from the bark of the Mexican Guayule shrub. But the only successful method adaptable to the many varieties of trees invariably involves an incision through the bark.

The Hevea Braziliensis

There is however a difference between the Hevea and the other varieties. The Hevea is not particularly copious in its yearly flow but it boasts of great permanency and steadiness in its yield. It is unique in possessing what is known as "wound response," that is, an ability to sustain a series of new cuts at rapid intervals without any loss in quality or quantity. It is this permanency of yield and the intrinsic toughness of its latex which makes it the nonpareil of rubber producers. The Hevea product is generally implied in the term "Para" in classifying rubber,

and Para is the Sterling and Sheffield of rubberdom—a prime factor in determining quality.

The development of plantations as a vital factor in the crude rubber market covers a comparatively recent period. The pathway of the pioneers in this work was beset with many unusual difficulties—in fact it is fairly well substantiated that it was even necessary to resort to smuggling in order to get the young Hevea shoots out of Brazil.

Plantation Development

The crude rubber business is of course based on supply and demand. In 1910 when the real facts as to the probable development of the tire industry began to be digested, there was a wild scramble for rubber shares. It was evident that the existing supply could not take care of the demand and rubber jumped from a normal price of 60–90 cents a pound, to quotations of $2.50+. Plantation or cultivated rubber took a new lease on life and capital into the hundreds of millions was invested in developing existing plantations and locating new ones. It is an axiom that things done in haste are often done poorly and this is particularly true in this instance. In the first place not every rubber tree is adaptable to profitable cultivation and great care must be exercised not only in the location but also in the management of the plantation. It is hardly a business for bunglers or well intentioned amateurs. The temptation to mismanagement was in this case unusual, for with top prices and great demand it often transpired that trees were planted wholly with a view to quick results rather than permanent high quality yield. In other instances plantations of the highest order were ruined through too much constant tapping either before or after maturity. In the matter of location there was a wide choice, for ap-

proximately wherever land can be found in that great domain north and south of the Equator lying between the Tropic of Cancer and the Tropic of Capricorn, there

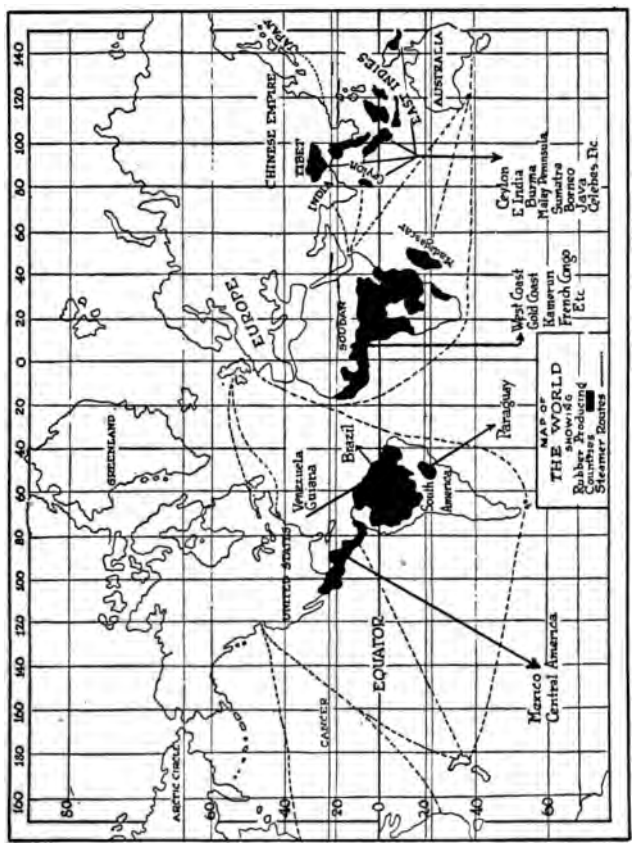


Fig. 3. Map Showing Rubber Producing Countries Adapted from Ravenstein's Atlas

is a suitable climate and more often than not a suitable soil. This broad belt (see Fig. 3 map) extending around the whole twenty-five thousand miles of the earth's greatest circumference embraces Mexico, Central America,

South America (north of Argentina) practically all of Africa, together with Ceylon and Southern India and the majority of the islands of the Pacific. It is the latter taking in the Malay States, Borneo, Java, Sumatra and the Philippines that have, with Ceylon, played the

Fig. 4. Jogging the Pole to Release the "Biscuit"

biggest part in the development of plantation rubber. Conditions there are ideal and it was only necessary to carefully transplant the young shoots in this genial soil —put them under scientific management and await large and ever increasing profits. But the desire to get rich quick was too strong in many instances and errors

were made which seriously affected the industry. In the first place it is only the Hevea tree which can be made to produce a supreme latex under cultivation. But this tree does not produce until four or five years after the shoots are planted and then only about 200 lbs. to the acre. With growing maturity a gradual increase in

Fig. 5. The "V" Shape Method of Tapping

production is noted until a maximum yield of 600 lbs. to the acre may be obtained.

Tapping

The untutored brown brother of Brazil was probably the first to draw gum from the tree. His method was simple but wasteful. He would make a series of gashes in the form of V shaped cuts placed one under the other and with a

vertical connecting channel, with an incision at the top leading off to the right at about 45 degrees. The cup is placed under the vertical channel and the sap will flow from it for about two hours in the morning for a considerable length of time. Gradually new incisions are made directly under the first and the central channel

Fig. 6. The Channel or Herringbone Method of Tapping

lengthened until at the end of a year the incisions have been brought down to within 18 inches of the ground. Assuming that the first tapping was done on the south side of the tree, the whole process will then be started over again on the easterly side, and after a year on the northerly side until after four years the gatherer has worked around to where he started. By this time the original tap has been reached. Nature has been active

in her healing process and with the aging of the tree, there is a strong probability that the second incision will be even more productive than the first. Other

Fig. 7. The Spiral Method of Tapping

methods such as the spiral incision are also used, but it is said the above is most generally used.

Coagulating the Latex

There is a wide divergence of opinion as to the best way in which to coagulate the milky sap. As it comes from the tree it is really an emulsion rather than a solution, that is the particles

of rubber float in a liquid much as particles of butter appear in buttermilk. The word "sap" itself is a misnomer—it is expressive but not technically correct because sap means the life blood of a tree pulsing through its trunk proper, while the latex emulsion is found between the trunk and bark. The problem is to draw off the rubber separately, imparting to it a degree of firmness that will render it easy to handle. This process is coagulation. The native method has already been touched upon, and it is claimed by many authorities that this rudimentary process yields the best results. It is claimed that the heavy smoke of a fire made from cocoa palm nuts has a beneficent chemical effect on the latex and imparts a higher degree of toughness to it. At the same time it is a slow and wasteful process, in fact when the rubber is washed and refined at the factories, there is a shrinkage of from 15 to 40 per cent. on the wild rubber due to the particles of dirt and bark embedded in the biscuits. In the plantations of the East Indies a chemical coagulation is being obtained by the use of acids and it is probable that this will be perfected to such a degree that it will be uniformly used.

Just as Good as Rubber? It is inevitable that attempts should be made to counterfeit any article of prime commercial importance—many efforts towards adequate substitution are beneficial and effect great national economies as, for instance, wood alcohol, where equivalent results have been attained at a vast saving. Rubber however has successfully resisted all attempts to displace it, through the agency of a chemical substitute. In practically every instance however, these attempts have had a sinister influence on the rubber trade. Great expectations have invariably been followed by dismal failures and large monetary losses.

Simple Simon and His Synthetic Rubber

Simon is usually a half baked chemist of an earnest and trusting nature. In fussing around his laboratory some day, he submits a hunk of beeswax or vegetable oil or asphalt to boiling or acid fusion or something or other, and the next day the world is astounded by the news that Simon has beaten the crude rubber trust to a pulp and is about to revolutionize the business. It would be a pleasing addition to the gaiety of nations if the thing went no further than that—but it usually does. Simon becomes filled with financial fervor and gets ostentatious with local capital and the next stage is the foisting on the public of some more or less Preferred and very Common shares in the Simon Synthetic India Rubber Co. Ltd. The third chapter sees the plant in operation and a heartening output of something that looks gummy enough to be rubber oozing out of it. The final installment is a tragedy—something has gone wrong and there is no market for the mess. It somehow fails to do any of the things that a buyer would have reason to expect from rubber. By the time the chewing gum people have gotten contemptuous an assignment to the creditors becomes advisable.

The German Chemist

It is pretty well understood that when a German chemist spits on his palms and gets active with the retorts and Bunsen Burners —something is about to transpire. Give him a slightly decomposed potato or the residue from a gas works, and he can duplicate everything in the Pharmacopœia and have enough left to start a dye Factory. During the war, however, the need after munitions was for artificial food, gasoline substitutes and synthetic rubber. The chemists got busy with their potato again and turned out some creditable near-gasoline but they fell down

hard on the food and rubber with the result that these necessities are as scarce in Germany as dress suits in Mozambique. This being the case it would be reasonable to assume that our own fair-haired boys have about the same chance as a snowball in a Turkish bath. It is a truism that Necessity is the mother of invention and never was there a greater necessity than in beleagured Germany since 1914—yet this necessity acting on the greatest minds in chemistry has produced not so much as an ounce of *practical* synthetic rubber.

Gilding the Lily

Gilding the lily or painting the rose are just about as sensible processes as wasting 90 H. P. intellects on improving rubber or creating it artificially. Rubber is just about right *as it is*. It is the marvel of the vegetable kingdom and unlimited in its practical use to mankind. Aside from abnormal conditions existing in Germany today, and to a lesser degree throughout the world (due to lack of labor and transportation) a real shortage does not exist. New plantations are increasing very largely in production and this will continue with maturity and efficient methods. It can be safely said then that the world supply is well ahead of world demand, and is elastic enough to continue that way. As witness to this fact, the price of the best grades of rubber are far lower today, than in 1910. Whatever fluctuations there are today, are due wholly to freight rates, labor, duties, etc., not at all to the potential supply of the gum.

Future of the Gum

While so called synthetic rubber has not proved a success, the chemist has accomplished many things of supreme importance. He has multiplied the uses to which rubber can be put and in every case has either turned out a more reliable product or has achieved a snug saving in price.

These things are of immense value to the consumer in these days of rising costs with its consequent tendency towards shoddy and adulteration. Take leather—here is a product whose supply is distinctly limited, as reflected by inexorable advances in shoes during the past decade. Already the release of great quantities of sole leather has been accomplished by the discovery of a rubber composition which not only outwears leather, but also presents an extremely neat and fashionable appearance. Day by day the sphere of usefulness is being broadened in scope and the future augurs well for a still greater conservation of National resources.

An Assured Supply

It is a very comforting thought that the output of rubber can be counted on to keep pace with practically any demand made upon it. In contrasting conditions applying to rubber supply with that of minerals or metals, it will be readily seen that the comparison is altogether favorable to rubber. A mine has a definite limit of yield, but a plantation knows no such limit, for its producing power is limited only to its size, and the energy put into cultivation. The land available for successful cultivation too, is vast enough to assure a potential output so large as to be practically inexhaustible. This might also be said of cotton, were it not for a fact that cotton is a more fastidious plant and suitable land for its cultivation does not exist to any such encouraging extent. In this connection however the irrigation of arid lands in the Southwest holds out a most sanguinary promise in that respect. There are today over 10,000 acres under cultivation in Arizona alone, and the soil and climate lend themselves to the production of an extremely high quality, long staple, grade of cotton—the kind that is so essential to the tire world for its fabric.

Reasonable Prices Expected

Viewed from any angle the possibilities as to prices on rubber products are exceedingly optimistic. We are rapidly becoming independent of the wild rubber, and improving the quality and output of the plantation product. In 1907 about 66,000 tons of uncultivated rubber was used against 500 tons of plantation gum. Last year (1916) only about 48,000 tons of rubber came from the uncultivated regions, while the plantation yield was about 145,000 tons. In ten years the supply of rubber has been tripled and today cultivated rubber alone amounts to twice the total world's output of ten years ago. The next decade will undoubtedly see a greater production and a lowering of cost on both the crude and finished products. The end of the great war should see a marked stimulation in the industry, as new capital and brains will be put into it. Great headway can be expected in the solution of the labor problem, the reduction of marine freight rates and improved methods of tapping, coagulation and preparing the gum. It is believed that such great strides will be taken along these lines as to eventually free the manufacturer from any dependence on wild rubber. A prominent resident of Singapore long identified with plantations is authority for the statement that increasing yield and efficiency will result in staple quotations on best grades of a shilling a lb. F. O. B. Singapore. By 1925 the uses of rubber will be even more diversified and in various forms will enter into the daily life of the people to a degree barely intimated at present.

CHAPTER III

Development of Tire Making

Pneumatic Tire Made Modern Automobile Possible

The automobile cannot be classed either as an invention or a discovery—it came about through the independent work of many minds working toward a common end. At its first successful stage it represented the harmony of many different evolutions. The most prominent of course was the development of a practical engine—steam, gasoline and electricity have been tried in turn and while it has not as yet been determined which of these will be the accepted type of the future it is a settled fact that all three types are practical. The greatest problem encountered by the pioneer automobile engineer was how to cut down weight and decrease friction. Multiplying cylinders helped; so did ball bearings and these factors coupled with the increasing refinement of steel tempering solved the principal mechanical problems. But the medium of traction—that is of applying power without waste in propelling the car, awaited the resources of the rubber manufacturer. He had, it is true, a fund of experience gained through the development of solid and pneumatic bicycle tires. The situation was hardly parallel however, as the traction requirements of the massive and speedy automobile were all out of proportion to any demand made on rubber and fabric in the past. In the emergency the solid tire, which had very definite limitations as an equipment for pleasure cars,

was made to do the work until a more perfect equipment could be devised.

Early Tire Types It was seen at once that the solid must give way to the lighter and more resilient pneumatic type, thus utilizing that greatest of all shock absorbers—compressed air. There was available the two types of pneumatic bicycle tires—one without and one with an inner tube. It was the latter which became the object of uninterrupted improvement even to this day. In this work Dunlop, Michelin and Tillinghast in Europe together with the G & J, Morgan & Wright, Diamond, Goodrich, and other companies in America brought to bear every resource at their command. As they worked somewhat independently of each other it was not long before several different types of tires were produced—each one had its own advantages and disadvantages and each one its group of enthusiastic partizans. These acute differences have largely disappeared by a process of standardization and the tire of today readily falls into one of three major groups, Clincher, Quick Detachable Clincher, and Quick Detachable Straight Side, differing only in the shape and composition of the bead. Care must be taken to avoid confusion between Q D Clincher and Q D Straight Side.

Rim Fundamentals Now although somewhat confusing a most essential detail of tire salesmanship is a clear understanding of the different Rim types and the corresponding tire beads which they are made to accommodate. It would be pretty soft if the manufacturer could confine himself to *just one type* of tire—calling for but *one kind of rim.* The reason he cannot do this is because cars of widely different tonnage present different problems in tire equipment. Knowing these requirements will help to clear the matter

in your mind, and by referring to the diagrams on page 33 *the* WHY of the whole question should be apparent.

The Clincher

The first really practical method of attaching tire to rim, was the clincher type. The steel rim shown in Fig. 8 was of one piece having two flanges curved *in*. The tire carried a hard rubber bead so vulcanized as to be slightly "stretchy" and the diameter slightly less than that of the rim. The result was that by using "tire-irons" as shown in Figs. 9 to 13 it could be forced over the flange of the rim after which it would settle down snug—the bead "nubs" or "cams" being retained by the curved rim flange as shown. This type soon became the standard equipment—and it has proved permanently practical for small light cars. This type, however, was not adaptable for the larger and heavier cars, because the large tires were difficult to force over the flanges and when finally in place, the stretchy bead allowed them to "creep" so as to break the valve stem, particularly when at high speed. Complicated stay bolts were used for a time, but they proved impractical and cumbersome. When not used there was a great hazard of throwing the tire off in motion. Something better had to be developed—and it *was* very quickly in the Q D or Quick Detachable type.

Q D or Quick Detachable

About 1905 experts recognized that in large sizes the bead must be non-elastic as the centrifugal force developed by a large tire revolving at high speed put an undue strain on the slightly stretchy Clincher beads—a strain which tended to lift the beads over the rim. The tire could not of course be stretched over a Clincher rim, but this was met by making the outside flange in the form of a ring and removable. See Fig. 14. By removing the ring the tire could be slid into place with ease and the

Fig. 8. Clincher Tire with Corresponding Rim

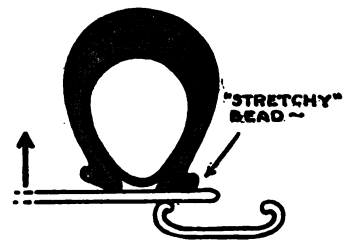


Fig. 9. Inserting Tire Iron. Arrow Indicates Stretching Bead

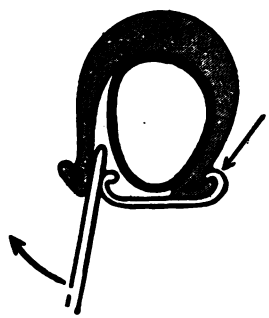


Fig. 10. One Bead in Position. See Arrow

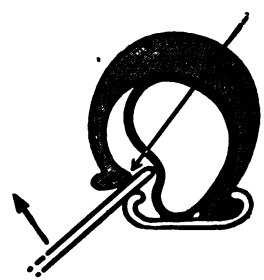


Fig. 11. Forcing the Other Bead Over

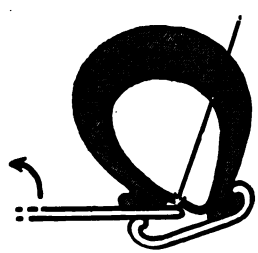


Fig. 12. Withdrawing Tire Iron

Fig. 13. Ready for Complete Inflation

ring replaced. This done, there was no chance for the tire to "creep" or by stretching—come off the wheel. This type is today the most popular on large cars carrying sizes 34 x 4½, 36 x 4½ and larger, the Firestone, S. R. B. and No. 52 Stanweld being amongst those generally used by discriminating buyers.

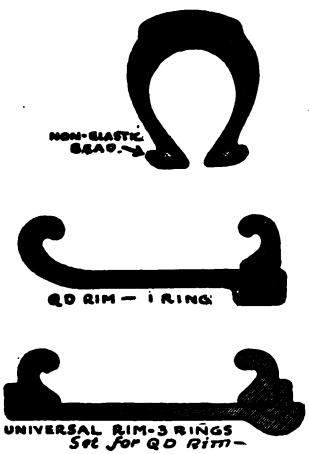


Fig. 14. Q D Tire with Corresponding Rims

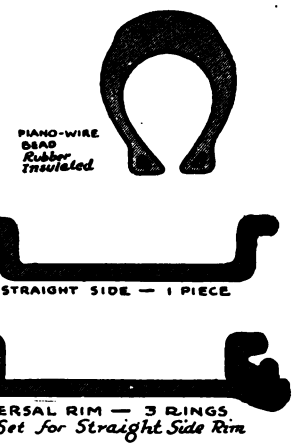


Fig. 15. Straight Side Tire with Corresponding Rims

Straight Side

There was still room for further improvement. The curved in cams of Q D tires often caused rim-cuts and side wall breaking—particularly when not fully inflated. To somewhat offset this, a tire was made carrying a bead with a straight edge as illustrated in Fig. 15. The bead itself composed of many strands of piano wire vulcanized into a bed of hard rubber. This gave it great rigidity and gripping power so much so, it needed no "clinch" to hold it tight—the only function of the flanges being to prevent the tire from slipping off the side of the rim.

When this tire was put into use it became an instant success. It incorporated the Quick Detachable feature and it was found that the tire never came off in running and that a greater relative air space was available. This added air capacity was important as it tended to lengthen the life of the tire just as an over-size does and rode with greater ease. The rim for this tire was easy to make and by being simpler and lighter a spare rim with tire already attached and blown up, could be carried with ease. This straight side is a one-piece steel rim with a small section that can be removed. The rim is flexible and bending it in on itself its diameter is reduced so the tire can be slipped over it. A simple tool is then used to expand the rim so the small section can be replaced and locked. There are other generally used straight side rims, such as Goodyear Quick Detachable, Straight side, and Stanweld Quick Detachable Straight Side rim No. 51, but the basic principle is the same.

Universal Rim

With the addition of the Q D and Straight side tires to the clincher type, there came a demand from car owners for a rim that could be used with any tire. A fertile brain conceived the Universal Rim shown in Figs. 14 and 15. You will note that by a series of rings this rim can be made readily available for either Clincher Q D or Straight side tires. These rims are made by Goodyear, Stanweld, Firestone and others and are entirely practical.

In a Nutshell

There is a clearly defined field. Cars carrying tires 30 x 3, 30 x 3½ almost invariably use the Clincher—it is undoubtedly the best type for light cars. The heavy machines operating under considerable speed find the Q D the most adaptable—hence the almost universal use in sizes above 35 x 4½. The Straight side is gradually monopolizing

the medium weight field, and particularly on sizes 32 x 3½, 33 x 4, 34 x 4, and 35 x 4½. The increased demand for Universal rims has caused an invasion by the straight side into the field of larger sizes. Increased air capacity make them to be desired where the rim will accommodate them. A tendency is also apparent even amongst the manufacturers of fairly heavy cars to make the straight side a standard equipment—notable amongst them being Cadillac and Peerless. It would not be a wild hazard to say that the field may eventually narrow down to clincher for very light cars and straight side for the balance.

Clearing Up the Deadwood

One of the most entirely praiseworthy institutions connected with the automobile industry is the Society of Automobile Engineers. The S A E (as it is usually known) has been grinding away for years at standardizing and simplifying automobile parts and accessories. When they turned their attention to tires, they got right up to their ears in a gorgeous mess of sizes and types. The vogue of foreign cars amongst our idle rich has already inflicted a lot of metric sizes on the trade, and to make matters worse our domestic auto manufacturer was often given to making his car "out of his own head"—trusting to a just Providence that he could scare up a tire that would fit. This is perhaps a little overdrawn—but certainly there used to be a marked absence of a Get-together spirit between auto and tire makers. But that's all past now. The S A E boys had a pow-wow and urged that manufacturers confine themselves to nine standard sizes and nine corresponding *oversizes,* and their recommendations have been generally adopted. This schedule will bear further condensation in the future because nothing is as yet settled or permanent in the automobile

industry. Changes in car weights and engine speeds bring about corresponding changes in the design.

Standard Oversizes

Metal Rim Diameter	Standard Tire Sizes	Oversize Tires	Metal Rim Diameter	Standard Tire Sizes	Oversize Tires
24	30 x 3	31 x 3½	25	34 x 4½	35 x 5
23	30 x 3½	31 x 4	27	36 x 4½	37 x 5
25	32 x 3½	33 x 4	26	36 x 5	37 x 5½
24	32 x 4	33 x 4½	27	38 x 5½	39 x 6
26	34 x 4	35 x 4½			

A careful tabulation of the tires used by all cars that are still in active use will demonstrate that at least ninety per cent. of them find their tire equipment among the 18 sizes in the S. A. E. list, while ninety-eight per cent. of the new car models confine their equipment to sizes in the above table.

Now while there are some tires occasionally used outside this list it is a good basis to start from as the exceptions are few, but even this list is subject to cutting. The extreme sizes 36 x 5, 38 x 5½ with their oversizes 37 x 5½ and 39 x 6 are negligible—cut them right off your list—leaving then only 7 standard and 7 oversizes. It is an easy list to remember because the measurements of standard sizes fall into even numbers and these are easy to group, two each in 30, 32, 34 and one in 36. The two 30's are Ford sizes which every one knows—leaving but five more sizes to lay hold of. You do not have to concern yourself with *oversizes* at all—just add one inch to your standard tread-to-tread figure and ½ inch to your cross section size, and there you are.

The "Oversize" Formula

By the way, such expressions as "oversize" or the phrase "34 x 4" are too often mere glib words—meaning nothing to all but the veteran dealers and clerks. The true inwardness, however, is easy to get at and for any one

so fortunate as to possess a quarter a dime and a nickel at one and the same time, a visual demonstration can be arranged that will clear the matter up.

Place the quarter on a sheet of paper and using it as a guide, make a circle inside of it and using a nickle, make a smaller circle and repeat again using a dime. This will give three circles with a common center. Through this center draw a line East and West. We will now analyze a very common "standard size" 34 x 34. We'll find out what the 34 x 4 means, why the tire is called "standard" and what its "oversize" calls for. Mark the line bounded by the inner circle "26 inches," mark the spaces between the inner and the next circle 4 inches, and between the second and outer circle ½ inch. The inner (dime) circle represents the metal rim, the next (nickle) circle represents a 34 x 4 tire placed on the rim, while the outer circle is the perimeter of the "oversize" tire which will fit the same rim.

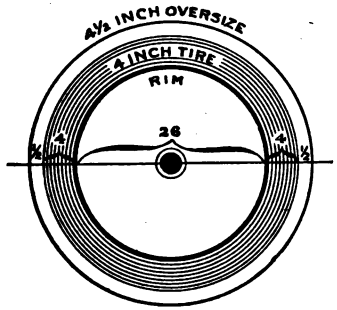


Fig. 16. Illustrating Oversize Formula

The Plot Thickens

Now add to 26 inches (which is the diameter of the metal rim) the two four-inch cross sections of the tire itself and you have 4 plus 26 plus 4 or 34 inches; this is the diameter of the tire from *tread* to *tread* so the larger figures will always indicate ON ANY SIZE TIRE a tread-to-tread diameter and the smaller figure will represent the cross section "tread-to-*bead*" diameter of the casing.

Now let us see how we can get a larger size tire on this

metal rim—it is 26 inches and any tire must fit it tight to stay on—so the Bead-to-Bead measurement of the tire must also be 26 inches. To make a bigger tire to fit the same rim, we can increase *only* the cross section of the tire itself—build it on a bigger core—use more rubber and fabric and this is exactly what is done. It is customary to add ½ inch to the diameter (represented on your diagram by the spaces between the two outer circles). Now add add your figures left to right ½ plus 4 plus 26 plus 4 plus ½ and you have 35 inches for your tread-to-tread diameter. Add that increase of one half inch to your four-inch cross section and you have 4½ inches as your new tire cross section. This gives the second figure of the oversize, which makes it 35 x 4½. Now there is usually but one oversize for each standard size and standard tread-to-tread sizes are generally EVEN NUMBERS divisible by two, such as 30 x 3, 30 x 3½, 32 x 3½, 32 x 4, 34 x 4½, 36 x 4½, 36 x 5. If a man asks for an oversize for say 33 x 4½ you will know "there ain't no such animal." The odd figure 33 indicates he already has an oversize. Summing it up "standards will always be even numbers and to get the oversize add 1 inch to the tread-to-tread diameter and ½ inch to cross section diameter. Oversizes will always be odd numbers, 31, 33, 35, 37, etc., and to find standard tread just subtract 1 inch from tread-to-tread diameter and ½ inch from cross section diameter.

Exceptions

It is the exceptions that prove the rule and there are exceptions here. For instance the once popular 35 x 4 which is a sort of "Under Size" for the standard 36 x 4½ tire is still in considerable use. Another instance also comes to mind, relating to the standard equipment of the rear wheels on a Ford car which is size 30 x 3½. At the outset of the

"jitney" business there occurred a wholesome demand for the oversize 31 x 4. Increased loads call for increased tire equipment and the oversize was exactly what was needed. It furnished a bigger tractive grip on the road and had a vastly larger cubic space to contain compressed air. The success of this "oversize" stimulated certain manufacturers to excessive zeal and we now have an *oversized* "oversize" in the 32 x 4½. In fact the Ford car is a law unto itself and thinks nothing of breaking a precedent here and there. Here's another one. The standard front equipment is 30 x 3 and it has an oversize 31 x 3½ that is made by nearly all manufacturers. Now it is a fact that the Ford front wheel has a rim diameter slightly larger than the rear—about an inch—although the cross section of the standard rear tire is ½ inch more. A little first hand experimenting by some shrewd Ford man demonstrated that the husky rear tire could be used very nicely on the front—thus yielding a very practical oversize. This was due to the fact that the clincher bead allows for considerable stretch and the bead in this instance was only obliged to lengthen itself by a slight amount. *Note that this short cut, while possible, is not advisable.*

Best Selling Sizes and Why

Here's a little chart showing the tendency of auto manufacturers in tire equipment. It is compiled through listing each year, the tire sizes of every model put out by auto manufacturers—and getting a percentage of each size to the total. As it covers a period of three years, it is very interesting for comparison.

Caution must be used in digesting these figures for it must be understood that these percentages apply only to the total number of MODELS and not to the total Tire consumption. It is valuable only as it shows the present

Chart Showing Changes in Tire Types and Sizes

Tire size	Jan. 1, 1915	Jan 1, 1916	Jan. 1, 1917	* Sept 1, 1917	SS	QD and clincher
31 and less..	6.1%	10.3%	12.2%	11%	00%	11%
32 and 33...	17.7%	31.6%	28.6%	34%	26%	8%
34 and 35...	40.0%	41.3%	47.6%	46%	38%	8%
36 and 37...	36.2%	16.8%	11.6%	9%	3%	6%
	100.0%	100.0%	100.0%	100%	67%	33%
Straight side	55.4%	60.2%	65.0%			
Q D or Clincher	44.6%	39.8%	35.0%			

* September 1, 1917, includes several 1918 models.

market and future tendencies. For instance 12.2 per cent. of 1917 model cars carry sizes 31 inch and less, but considering the number of Ford cars in use, it is probable that over 50 per cent. of *all tires made* are 31 inches or less, and this ratio will probably increase in the future.

Tendencies

Note that current equipment as shown is now *two thirds* straight side and still gaining. Group "32–33" and group "34–35" have together reached 80 per cent. of total equipment, the "31 and less" group holds steady at between 10 per cent. and 12 per cent. All three lower groups have gained heavily at the expense of the "36–37" sizes.

The ever present exception here is the tendency to decrease the "tread-to-tread" measurements and enlarge the cross section. It is in the cross section, more than in the tread-to-tread that we must look for the measure of a tire's efficiency and ability to stand the gaff. For instance the 32 x 4 has such a perfect balance of the two specifications that its oversize 33 x 4½ is rarely seen. Many manufacturers are dropping from 37 x 5 to the staunch and rugged 35 x 5, notably Packard on all 1917 models and Pierce Arrow on the 38 and 48 H. P. Models

produced after June, 1917. This tendency may continue to a point where it will be necessary for the S. A. E. to give us a new schedule of standards and oversizes, in which some such size as 33 x 6 will take the place of the popular 34 x 4—but as Kipling says "this is another story" and it will keep.

Passing mention has been made of metric sizes and a chart is presented herewith showing these sizes and their approximate equivalents. Their use in this country has never been appreciable and grows less with each passing year. In fact foreign dealers are in many instances adopting the schedule in use here.

Metric Sizes and Their Equivalents

Metric Sizes	Approximate Size in Inches	Metric Sizes	Approximate Size in Inches
650 x 65	26 x 2½	870 x 90	34 x 3½
700 x 65	28 x 2½	910 x 90	36 x 3½
750 x 65	30 x 2½	960 x 90	38 x 3½
800 x 65	32 x 2½	1010 x 90	40 x 3½
830 x 65	33 x 2½	815 x 105	32 x 4
860 x 65	34 x 2½	875 x 105	34 x 4
700 x 85	28 x 3¼	915 x 105	36 x 4
750 x 85	30 x 3¼	820 x 120	32 x 4½–5
800 x 85	32 x 3¼	850 x 120	33 x 4½–5
860 x 85	34 x 3¼	880 x 120	34 x 4½–5
760 x 90	30 x 3½	920 x 120	36 x 4½–5
810 x 90	32 x 3½	1020 x 120	40 x 4½–5
840 x 90	32 x 3½	1080 x 120	42 x 4½–5

Care must always be taken to impress on a customer the vast difference between Q D Clincher and Q D Straight Side rims. There is room for confusion in that both are quick detachable in the sense that they are applied with greater ease than the clincher. Both have inelastic beads and the difference lies wholly in the shape and composition of the beads.

CHAPTER IV

Manufacturing Mileage

It is essential that the dealer should know at least the rudiments of tire making so as to better judge the values of the tires brought to his consideration. He will find this mastery of immense value in making sales—and it will pay him fine dividends in the advantage it will give him over a competitor not so well informed. It is hardly necessary to consider here the small details which involve minor technical matters—the outstanding features alone demand earnest attention.

Early Developments

Charles Goodyear did not as many suppose *discover rubber.* It had been in elementary commercial use long before his time. What he did do was to devote years of experimenting on the gum in an effort to make it available for practical use by "tempering" it. In 1839 he discovered that by adding sulphur in small quantities and baking the rubber, a high degree of toughness was obtained. This was the beginning, and from Goodyear's crude formula, there has developed the intricate and highly scientific vulcanizing and compounding processes of today. In addition to sulphur, litharge, oxides and other mineral agents have been introduced into the compound according to the more or less secret formulæ of the individual companies. In tire vulcanizing it has been found that in addition to *compounds* and *Heat,* a

third element, that of *Pressure* is of vital importance. Whatever the curing or vulcanizing process may be it must involve a *Compound* subjected to considerable ***heat*** for several hours, and at a certain *Pressure*.

Washing

The source and nature of rubber together with methods of tapping and coagulating it have been touched upon in a previous chapter. Let us imagine it loaded on ocean going steamers at the docks of Para, Manaos, Colombo or Sing-

Fig. 17. Washing Rubber

apore and follow it across the seas until it has been unloaded at an American port and finds itself in the huge bins of a rubber factory. The first process is that of washing or refining the crude gum. It must be steeped in hot water until thoroughly softened, and is then ground between corrugated steel rolls (Fig. 17) which flatten the lumps into thin sheets while a stream of water plays over the mass washing away the impurities. Para rubber in biscuit form (See Fig. 18) has a high degree

of shrinkage under washing as much as 17 per cent. and over, while the lower grades suffer a loss as high as 30 to 40 per cent. This loss of course must be added to

Fig. 18. Para Biscuits

the actual quotations of rubber as given from time to time. Ceylon and other high grade plantation rubbers are generally washed before shipping and some avail-

Fig. 19. Ceylon Mats

able for use in sheets or mats condensed in bales (Fig. 19) thus considerable labor is saved in this country where wages are higher; the loss of shrinkage is avoided

and a saving in marine freights is effected due to the condensing of the rubber into smaller cubic sections, and the fact that no freight has to be paid on the weight of the foreign substances.

Compounding

After every particle of moisture has been removed in the drying room, the rubber is then ready for compounding. It must now receive its quota of sulphur, litharge, zinc, oxide and other chemical agents, the formula varying in rela-

Fig. 20. Compounding and Mixing

tion to the particular part it must play in the Tire make up. Tread compounds must be developed to the highest temper so that they may withstand the tremendous buffeting and friction incident to the grind of the road. This involves a high percentage of chemicals and is done with the most painstaking care. On the other hand rubber used for impregnating the Fabric carcass, or for "cushion stock" consists of little else than pure gum with a small addition of sulphur. These chemicals are introduced into the rubber in a "Mixing Mill" (Fig. 20)

the compound being ground between a pair of hollow cylinders until thoroughly mixed. In this stage the rubber resembles nothing so much as a batch of dark dough which must be kneaded until, like dough, it is ready for the heating and vulcanizing process. After this the rubber is rolled into thick sheets, and is temporarily laid aside until required either for use in the tread, cushion, skim coat, or side wall.

Fabric

The process now divides itself into two parts. That having to do with the final shaping up of the rubber to the exact requirements of the maker, and that having to do with the fabric carcass, upon which foundation the tread and side wall are placed. The part played by the carcass in the life of a tire, cannot be overestimated. It is like the frame and ribs of a ship—it must be sturdy and staunch if it is to play its part well. Of all materials that might be considered for the foundation of a tire cotton reigns supreme. It forms a perfect partnership with rubber and its toughness and willowy strength make it an ideal material. Needless to say the market is combed for cotton of the longest and purest staple. This duck is sold by the pound and is graded by its weight in relation to the yard. Thus the best grades of Sea Island tire duck weigh 17¼ oz. to the yard and even the best is none too good for the vital function it performs during the whole life of a tire.

Calendering

The fabric follows its own course through the mill—being first impregnated with rubber to capacity by being forced through powerful "calendars" (Fig. 21). These immense machines have a sensitive adjustment extending to minute fractions of an inch and after the fabric has been repeatedly forced through them in conjunction with rub-

ber, in commercially pure form, it is called "friction." It is thoroughly impregnated with rubber in warp and woof and with a "skim coat" of rubber added to give it greater adhesive qualities. The "skim coat" also serves

Fig. 21. Calendering Fabric

as a fine insulation between each fabric ply. The duck is now ready for the fabric cutting machine.

Fabric Cutting

These machines cut the fabric on the bias, at an angle of 45 degrees with the edge of the roll, as in Fig. 22, and in strips of just the width necessary to extend from bead to bead over

Fig. 22. A Piece of Fabric

the top of the particular tire to be made. The machines are capable of very accurate adjustment and do their work almost automatically. Fabric cutting was for-

merly done by hand on long zinc tables, but from every standpoint the machine is in this process superior to the most skillful labor. These strips are afterwards spliced in such a way that they can be made into rolls of any required length.

The Tire Itself

We have followed both rubber and fabric up to the point where they are available for assembly into a finished tire. Let us now consider the tire itself—taking as example the cross section of a Q D Clincher tire like that in Fig. 23 and in dissected form in Fig. 24.

The Tread

This is the battlefield of Tire Mileage. A degree of toughness and resiliency must be obtained here surpassing anything ever obtained with a vegetable compound. The weight of a loaded car, proceeding at average speed, subjects the tread to blows like that of a trip-hammer when it encounters the slightest inequality of the road.

Breaker Strip and Cushion

This is a heavily woven elastic fabric which lies between the tread and duck carcass. It acts as a tie between the two and absorbs and distributes the hammering of the road so as to preserve the unity of the whole tire. It is impregnated with rubber and lies in a "cushion" of Para gum of great tensile strength.

Fabric Plies

There is a definite limit to the number of plies that can be advantageously placed in a tire. The ideal tire would be one that could be made of the least possible material. Mass and bulk beyond actual requirements develop heat—make for stiffness and unwieldiness. It is a common mistake to overload a tire with goodness—to embarrass it with unnecessary riches. This is sometimes seen in double breaker strips or in more fabric plies than good prac-

tice indicates. It is above all *balance* that is most essential in a tire, a harmony and coordination of part to part without undue accent on any one factor.

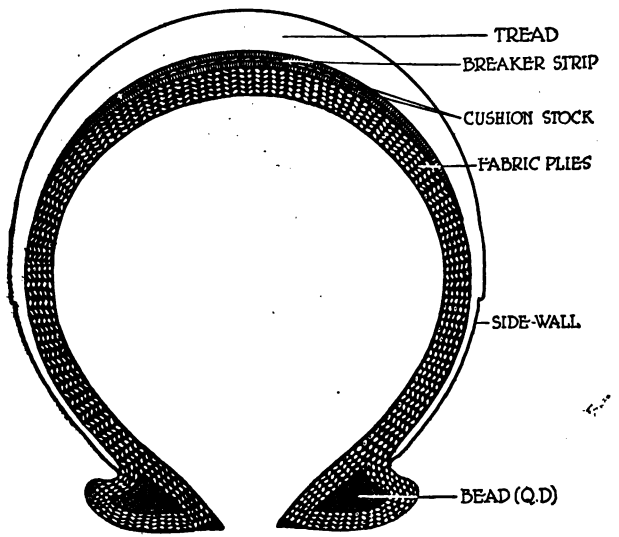


Fig. 23. Cross Section of Fabric Tire

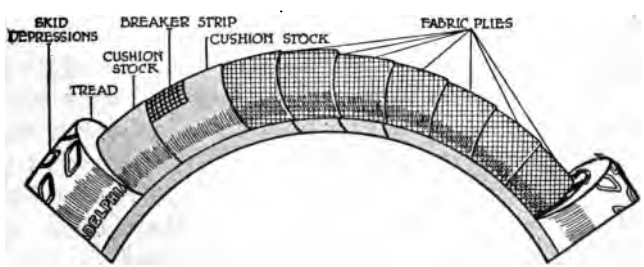


Fig. 24. Dissected View of Fabric Tire

The following schedule of Fabric piles is the rule in one of the factories producing tires of the highest calibre. It is doubtful if this quantity can be exceeded, without

detriment to the flexibility and balance of the product.

5	inch	tires	7	plies	and	breaker	strip
4½	"	"	6	"	"	"	"
4	"	"	5	"	"	"	"
3½	"	"	5	"	"	"	"
3	"	"	4	"	"	"	"

The Side Walls The purpose of the side walls is to protect the carcass from the elements—particularly moisture which quickly rots the duck. The thickness of the side walls has little to do with actual wear—but it must be tough and resilient so that constant bending will not produce heat, with consequent cracking of the compound.

The Bead As outlined previously the shape and composition of Tire beads vary according to type of tire. It is right here the only difference between the types occur. The Clincher carries a rubber bead cured slightly elastic. The Quick Detachable has a Composition rubber and fabric bead, cured so that it will not stretch—as has also the Straight Side but in a very different shape, and formed of multiple strands of "piano wire" imbedded in rubber.

Carcass Assembly The fabric is built up on an iron core resembling a wheel. Sometimes the duck is placed in position by hand but more often by machine. Both methods have strong advocates and it is hardly necessary to enter the discussion except to state that hand assembly is undoubtedly more expensive and if there were no advantages over the machine assembly it would be difficult to understand why so many reputable companies cling to it. At any rate, whether by machine or hand, the fabric is built up and the beads inserted so as to be surrounded and kept in place by the fabric plies. The metal core on which the tire is built

is attached to a "tire jack" in such a way that the core forms the circumference of a wheel which can be turned at any angle at the makers' will (See Fig. 25).

Throughout this entire process the greatest care must be exercised. A thorough overlapping of part to part must be assured so that with the curing process the tire

Fig. 25. Tire Assembly

is no longer an assembly of many separate parts, but will become as it were, welded into a compact unit.

Unit Molded Cure

The assembly of the tire having been completed by the maker it is placed in a steel mold. (Fig. 26.) In the case of non-skid types the mold itself is engraved so as to form the tread into the design used by the manufacturer and in addition thin plates of tin carrying the serial and makers' number are placed along the side wall so as to give it a permanent identity. The mold is then closed and along with eighteen or twenty others is placed in the vulcanizer. This large container is so arranged that tre-

mendous hydraulic pressure can be exerted on the molds at the same time that they are being subjected to the heat of live steam. Thus pressure and heat acting on the chemicals with which the rubber has been treated, accomplishes the great chemical change which trans-

Fig. 26. Tire Molds

poses a plastic and inert dough into the toughest and most resilient material imaginable.

Pro and Con

Among the arguments advanced in favor of the unit mold method are these. It is claimed that a greater and more uniform pressure is secured than in either the Combination Wrapped, or Unit Wrapped and that this pressure assures a greater density and compactness in the tire. In comparison with the double or combination cure it is urged that in the latter process a likelihood to tread separation is ever present as it is not under the unit mold cure. These divergent opinions, by the way, constitute the Manufacturers' talking points and, needless to say,

should not be taken too seriously by the dealer.

Combination or Double Cure

This process is confined largely to the production of Non-skid Tires as smooth treads are generally either Unit Wrapped or Unit Molded. There is practically no difference between this and the previous method in the initial stages. The carcass is built over an iron core but before the major portion of the tread is applied the uncompleted tire is partially vulcanized in a mold. It is then removed and the tread itself is applied after which it is wrapped with cloth and then finally cured in an open steam vulcanizer or "kettle."

Bead Assembly

The foundation or carcass now awaits its armor of rubber and we return again to our thick sheets of compounded gum. The order comes for delivery of a certain amount of

Fig. 27. Preparing Laminated Tread

tread stock. Before the assembly of the tread by the maker it must be "shaped up" for his use so that it will be uniformly snug along the carcass. This shaping up is

accomplished either by running the stock through what is called a tubing machine, or by partial molding and curing, or by building up the tread in sheets. This latter process is called "lamination," that is, an assembly composed of several thicknesses of stock into a single Unit (Fig. 27). These sheets are run through the calender so as to be about 1-16th of an inch thick and are placed on long zinc tables where they are placed one upon another, touched with naptha and rolled with hand wheels or rollers. This is a painstaking process but yields excellent results. The diagram in Fig. 28 shows a cross section of a laminated tread. Note how it is crowned up in the middle so as to put more "wear where

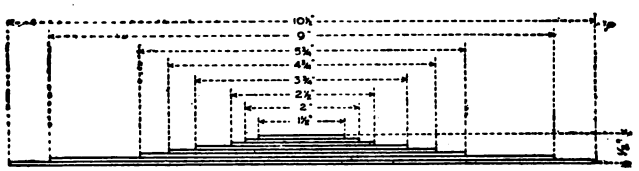


Fig. 28. Laminated Tread Assembly (Cross Section)

the wear comes." In actual practice this tread is applied to the carcass upside down so that the wider sheets extend down towards the bead and overlap the side-wall.

"Curing" a Storm Center

Probably no process in tire making is the subject of such vast differences of opinion as that of the best way to cure or vulcanize a tire. The three general methods, unit molded, unit wrapped and combination or double cure have a common end—to produce uniformly the highest product with a minimum cost. The writer will as far as possible adopt a neutral viewpoint in describing each. In approaching the matter it is interesting to note that instances of each method can be quoted wherein the re-

sults are practically equal in quality—ranging from poor to medium, and from medium to high excellence, yet there is a tendency on the part of each manufacturer to ascribe to his own process all possible merit, excluding other methods entirely.

The contentions made for this process are that it retains the advantage of both the Unit Mold and Unit Wrapped with the disadvantages of neither. It also makes possible the production of a raised or nobby nonskid similar to the Unit Molded design which is not practical with the Unit Wrapped method, wherein the nonskid must be formed by depressions in the surface of the tread. The arguments against this method are that the double cure involves the constant risk of under or over-curing, that the tire does not receive the relatively high pressure needed to make it a compact unit and that in any instance there is bound to be a line of least cleavage between the separately cured body and tread, involving the risk of tread separation.

Unit Wrapped Cure

In the one cure wrapped method the tire is built up complete on the core before vulcanization. When the assembly is complete, and the serial numbers and side rings inserted it is wrapped by a machine with sturdy canvas tape previously wetted down. This machine exerts a strong pull on the strip of duck, lapping and overlapping it in the wrapping process until the tire has received three plies. It is then wetted down with a hose and placed in large vulcanizing kettles, one tire above another with metal sheets between, and is subjected to pressure and live steam until cured. Unit Wrapped advocates advance the claim that the use of molds while the tire is in a plastic state often subjects it to displacements and that "carcass pinching" between the upper and lower halves

of the mold may easily lay a foundation for future blowouts. That the heat in which a molded tire is cured is utterly dry, whereas the Unit Wrapped method ensures a somewhat humid heat that will not in any way glaze the surface of the tire or devitalize it. The Unit Wrapped advocates join hands with the Unit Mold partisans in claiming that the Double Cure is fraught with

Fig. 29. Unwrapping the Tire

considerable risk as to over and undercuring and that the tire does not become the solid unit it should under that process. The Non-skid tires made with the Unit Wrapped Cure bring to light a certain limitation which might be construed as an intelligent criticism of the method. This is the fact that it is quite impossible to produce anything but a depressed anti-skid type. During the tread assembly previously described the upper portion of it is died out in such a way as to form depressions in various shapes such as circles, ovals, arrows, clover leafs, etc. Just before the tread is wrapped pieces of metal are inserted in the depressions so that

they will hold their shape during the curing process. A characteristic mark of unit wrapped tread tires is the ever present cloth marks on the tread between the side walls. It is a question whether this limitation to the depressed type of non-skid is really serious. Personally the writer believes that where the right design is used and the tread built up in thickness to an extent that will make up for the rubbers displaced by the depressions, a most satisfactory non-skid is produced. It is probable that the tire does not invite so high degree of wear from the road as in the case of corrugations projecting from the tread itself.

Summing Up

It is a question whether the reader will be able to form from information given above, any idea as to which type of cure is really the best. It is particularly true since each method has to its credit many excellent tires. Yet while the dealer should be able to intelligently discuss the three major curing processes, it is not primarily costs or methods but results that interest the consumer. At any rate "you pay your money and take your choice" in this instance. In all three processes the amount of heat and pressure is most accurately regulated by mechanical agents. Clock thermometers show visibly the length of time and the progress of the heat to its maximum, and at this stage the heat is automatically turned off. It is probable that the greatest fluctuation in a tire's excellence aside from the human factor in assembly, is due to variations in the rubber or duck. These variations do occur despite the most rigid inspection and analysis of raw material. The compound itself is as fixed as the laws of the Medes and Persians while the mechanical devices are unerring in uniformity, but the dealer must not expect perfection in every tire.

A Word on Tubes

As in tires so there is in tubes a choice of several methods of fabrication. A cheap and formerly much used method involved a "Tubing Machine" somewhat similar to a sausage grinder. The rubber in this machine was kept heated to such a degree that it became plastic and by means of a revolving screw was forced out in the shape of a tube. It could then be fitted over a metal shaping cylinder or "mandrel" and cured. The tubing was afterwards cut off in the proper lengths, valves inserted, and the ends spliced. Another method was to run out the rubber in sheets from which strips were cut of the length desired and of a width sufficient to encircle the mandrel. The edges of the strips overlapped throughout the whole length of the tube and there had to be an additional splicing at the ends. This method is now confined largely to the making of bicycle tubes. The best modern practice is to assemble the tube over the mandrel in long strips. These sheets are quite thin but wide enough to allow a wrapping of three or more times round the mandrel. The cure is similar to the unit wrapped method of tire curing as fabric plies are wound around the tube after which it receives its vulcanization. The tube is turned inside out after curing, so the cloth marks will be on the inside of the tube.

CHAPTER V

Manufacturing Slants and Angles

Other Manufacturing Differences

There are other points of difference between tire manufacturers aside from the question of the best vulcanizing process. "Hand-made vs. Machine Made" is still a matter of contention as is also "Cord vs. Fabric" carcass construction. The attitude of the public has been to consider the matter more from the standpoint of results secured—rather than the manner in which results are obtained. The issues are again confused by the fact that results vary so widely. There are relatively few hand made tires, and cord tires, which must be considered in relation to other hand made or cord tires of undoubted excellence. The mere fact that a tire is hand made, or has a cord carcass, is not of itself a warrant of supreme excellence. It is a favorable symptom, of course, but other factors must also be considered.

What Balance Means

Before going at length into the details it is well to remember that *Balance* which means a complete harmony of part to part is above all the great essential of a good tire. A tire made of merely medium grade material and by the cheapest manufacturing process has a better chance of producing uniformly good results than a tire made of supreme materials under a painstaking process—unless the splendid materials and workmanship are grouped together in a perfect harmony. Much of the real strength or weakness of a tire is concealed from view—prod it or heft it as much as you like you will know very little about it until the test of the road brings out its

real calibre. In judging tires then, be not so much concerned over manufacturing methods or with unusually thick treads or extra fabric plies, as with "balance" and results. A tire is only as strong as its weakest part—its whole strength is cumulative and depends primarily on absolute balance.

With Brains, Sir

A great artist was once asked by a pupil how he mixed his paints. The master replied "With Brains, sir." This briefly sums up tire manufacturing for in truth tire making in its highest forms attains something of the dignity of an art. It amounts to a great deal more than the helter skelter assembly of material. Many tires are made of the best available raw products, but this in itself is not a guarantee of their worth. Judged by such a standard every painting might be a masterpiece if the artist took care to use only fine paints.

Handmade vs. Machine Made

But to return to our topic—the handmade tire is right now enjoying a considerable vogue. It has been exploited both in advertisements and by salesmen until it has become a live topic with every dealer—a question that he must certainly be able to discuss intelligently. In the first place *no tire* is wholly hand made or machine made. Judging from a common sense standpoint however, it can be assumed that when a machine can be perfected to the point where it will do the work of a human hand —as well or better—it is adopted by every factory that can afford it, while those factories that cannot afford it are immediately faced with a serious handicap. Rubber being what it is, a sticky gummy material, it is probable that a larger percentage of hand work continues today than in any other staple manufacturing industry you might mention. Yet already the fabric cutting ma-

chine has superseded hand cutting in the modern factory and there remains today only two processes wherein there is any question as to the superiority of machines over hand work. In fact when a so called hand made tire is called to our attention, you may be reasonably sure that the hand work is confined to the carcass assembly and refers to nothing else unless perhaps the tire carries a laminated tread, which may imply considerable hand labor in its assembly.

Those companies which use the "tire building machines" to the exclusion of hand work, make the claim that this process of stretching on the fabric over the core—ply after ply—tire after tire, is a work that no living man can perform with any degree of uniformity. It is indeed stiff muscular work and one might infer that the last tire made at night will be inferior to the first one produced. It is however only fair to state that rest intervals are frequent, that is between each muscle strain there are periods where the work is more *deft* than *hefty*. Some companies use building machines on their 3, 3½ and 4 inch casings and revert to hand work on the large sizes. There is no question at all that for fine work around the bead, hand work is the most precise and leaves less to chance. The process too is slower and allows the greatest amount of inspection of each part as it takes its place. It is probable however that hand work will eventually give way to machines in this process, if the great strides made in that direction are any indication.

Cord or Fabric

Cord tires have come to stay. There is no question about that—but it is very doubtful if they will completely displace the fabric tire. In the first place not every cord tire is as good as a really good fabric tire, but in nearly every in-

stance they cost more. Cord construction involves a more expensive process than the usual fabric process and in passing the increased expense on to the consumer it is only natural for him to demand a considerable increase of mileage. In short the consumer has become educated to figure a tire's *worth* by its *cost* per running mile. Now a Cord tire does not necessarily yield more bulk mileage—for this is dependent on many other factors. It is probable that the maker of the best cord tire in use could make a fabric tire just as good, if mileage alone was the object to be obtained. The tread of a cord tire and that of a fabric tire have no essential differences and it is the tread which in most cases determines the running life of a tire unless some serious defect exists in the fabric or the tire itself is subjected to palpable misuse. What then, is the basis of cord tire vogue? Beyond a doubt it is an increase of resiliency which has of course a favorable effect on the life of the tread. This affords as well a high coasting ability which decreases the power required to keep it in motion, thus effecting a saving in gasoline consumption. These favorable factors undoubtedly pertain to Cord tires of the best type but there are cords *and* cords—some of which have proven more of a liability than an asset to their owners.

Cord vs. Cord

Figures 30 and 31 show sectional views of two cord types, the former being a two ply cable type and the latter a multiple cord type. Any cord tire brought to your consideration will group itself in general with one of these two types. The question then arises as to which of the two performs its work most creditably and it is a question that each reader must settle to his own satisfaction. Both these types have to their credit racing records both track and cross continental that have been given the widest publicity.

The real jury however is the legion of owners and it is from them that the real verdict must come. A canvass in your neighborhood will stir up some spirited discussions but the consensus of opinion will give the correct answer as far as you are concerned. The double ply cable cord is formed of two plies of very heavy cord and is built over a core entirely by machine—a series of hooks are arranged on each side of the bead and the cords extend from one side to the other at an angle with the tread of about 45 degrees. The machine exerts a strong pull on the cord and a series of mechanical fingers reach out to pluck the cord and pull it tightly against the previous one. The second layer is applied at right angles with the first and there is an insulation of rubber between the carcass lining and the first cord layer, as well as between the first layer and the second. The balance of the process does not differ essentially from that of the fabric tire as the tread and side-wall go on in practically the same way as in a fabric tire and with a vulcanizing process in no way different. The multiple

Fig. 30. Silvertown Double Ply Cord Tire

Fig. 31. Goodyear Multiple Cord Tire

cord type utilizes cords of considerable less bulk but as the name indicates there are many of them. These plies are also insulated in rubber so as to form a compact unit.

From a purely mechanical standpoint and without regard to results as they have actually been obtained, in practice it would seem that with all things equal the multiple cord type presents the better distribution of stress. In lumber working it has been demonstrated that two pieces of wood glued together will not always overcome warping, whereas four or five smaller pieces attached together so the grains come at different angles, will absolutely prevent it. But in this as in everything else it is practice rather than theory, that must determine value, and it is only results that count.

A Word on Non-skids

The Non-skid tire has become so popular with the public that probably 75 per cent. of all tires made are of that type. In addition to the element of safety obtained through their use, there exists a well defined opinion that the non-skid tire inevitably yields a greater mileage than the plain tread. It is extremely doubtful if such is the case except in minor instances, for the difference in the amount of rubber in the tread of each is generally quite small. Even where there is actually more tread stock the wearing ability tends to equalize as the corrugations and projections undoubtedly invite a swifter wearing down process from the road. As in the cord type the real consideration is something beyond mere mileage and the premium paid for a non-skin type must be charged in great part to increased security and traction. The premium in many instances is quite high, as in the Combination and Unit Wrapped process the non-skid design is obtained by methods which add appreciably to the factory cost, which together with such additional stock as may be

used, must be reflected in the consumers' price schedule.

The Perfect Non-skid

The perfect Non-skid, which every manufacturer is striving to attain, would embody the following functions:

(1) *Perfect traction*, or grip so the tire will instantly take hold on the road when the clutch is "let in." This calls for either depressions or ridges placed at ***right angles*** to the tread.

(2) *Lateral stability* or protection against skidding towards either side of the road. This must be met with ridges or depressions *parallel* to the tread or else suction cups of some sort.

(3) *Power* and *Speed*, while accomplishing items No. 1 and No. 2, must offer no handicap to speed or loss of power. In the case of some poorly designed raised non-skid types the projections on the tread produce about the same resistance to motion as would be offered by a slightly rutty road. An approximately smooth surface along the very center of the tread is essential if a "fast" tire is desired. Of course the above specifications are purely ideal, and perfection is never wholly attained—it does however give us a mark to shoot at, and by which we can measure progress. For your purposes then the perfect tire will be that one which most completely embraces the features of the ideal non-skid. The question cannot be settled by theory however, and while the clever draughtsman is of great value, his designs often suffer modifications when subjected to the practical test of road work over a considerable period of time.

Evolution of a Non-skid Design

An instance of how problems of design are approached and how in every instance theory gives way before practice is illustrated here. Fig. 32 shows the tire as originally designed. It was made under the unit wrapped tread

process and hence involved a depressed type of non-skid. As shown it consisted of a series of sunken capital D's along each side of the tread and from a theoretical standpoint embodied many of the features of the ideal non-skid. The smooth tread center made it a fast tire, while the sharp edges of the D shaped depressions afforded both the parallel and right angled resistance necessary to traction and skid prevention. Actual preliminary tests in this case superficially backed up the designer's theory, and it was nearly a year before actual road work demonstrated an inherent weakness and suggested a remedy. A tire tread, unlike the "Deacon's one hoss

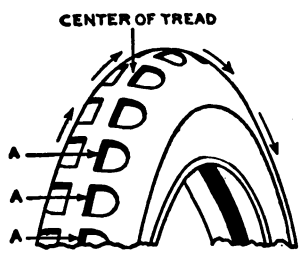


Fig. 32. Original Non-Skid Design

Fig. 33. Improved Non Skid Design

shay," has always some point of greatest strain, some place that bears the brunt of road wear. This is a thing that must be anticipated as far as possible in design and so re-enforced as to ensure a uniform and even wearing process. Now if you will consult (Fig. 32, Point A) you will note that with the tire turning in the direction of the arrows, the sides of the depressions had to bear the burden of giving traction to the car. When the clutch was let in, it was these edges which bit into the road—consequently it was these edges which were first to show the wear and tear of running. The only way to equalize this without disturbing the smooth speedy

center line, was to *put more rubber* where the wear came. Looking at Fig. 33 you will see this is exactly what happened. The depressions were reduced in size so that more rubber was placed at the point of strain. The new design preserved these virtues of the old, viz: smooth center line and grip on the road, while it increased its efficiency by adding re-enforcements at a threatened point. It adds a new feature by incorporating in a measure the suction principle and finally it has put more rubber into the tire without destroying its "balance." A further improvement would doubtless result from a "staggard" rearrangement of the depressions so they would not be directly opposite each other as they are in Fig. 33.

A Vast Laboratory

All Tiredom of today is a vast laboratory in which research and tests follow each other in an effort to make things better than they are. Theory lays out new fields for consideration while practice makes its relentless test for actual utility. The list of improvements made in tire manufacturing processes is a long one—it need not be presented here. At no time however has the industry suffered from any smug satisfaction as to things as they are. Progress is the paramount issue.

Some Non-skid Types.

A study of the Non-skid tires shown in Figs. 34 to 41 will illustrate how the problem has been approached by different manufacturers. The border line between the raised and depressed types is sometimes vague—the writer's object being merely to break up the great mass of non-skids into groups that can be classified with greater ease. From a technical standpoint a depressed tread implies a tire whose non-skid properties are obtained by depressions actually made in its surface. But the number and

Raised Types

Fig. 34 A

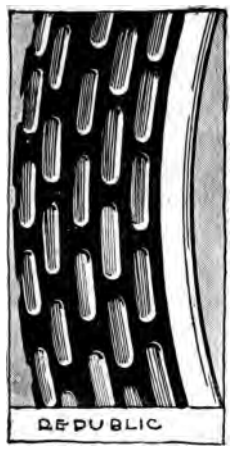


Fig. 34 B

Depressed Types

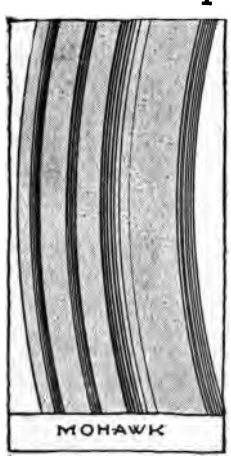


Fig. 35 A

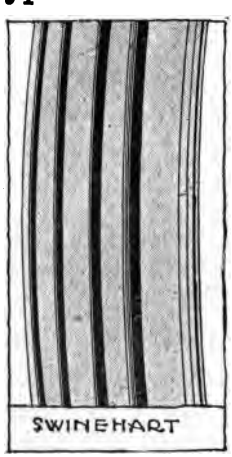


Fig. 35 B

Emphasizing Lines Parallel with the Bead

Raised Types

Fig. 36 A

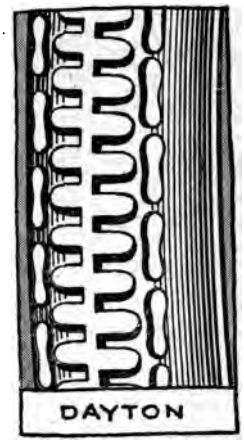


Fig. 36 B

Depressed Types

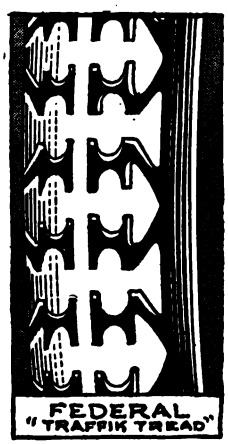


Fig. 37 A

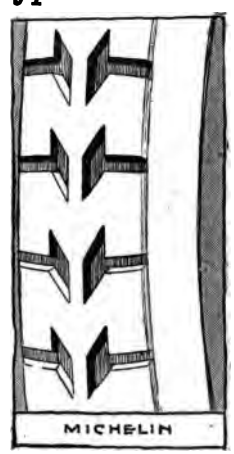


Fig. 37 B

Emphasizing Lines at Right Angles to the Bead

Raised Types

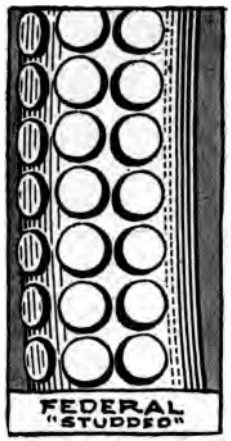


Fig. 38 A

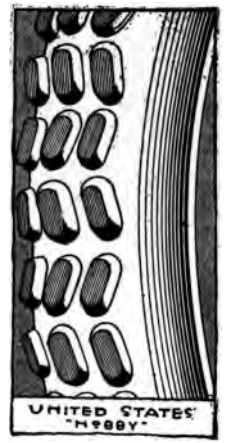


Fig. 38 B

Depressed Types

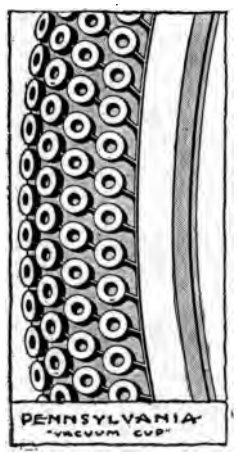


Fig. 39 A

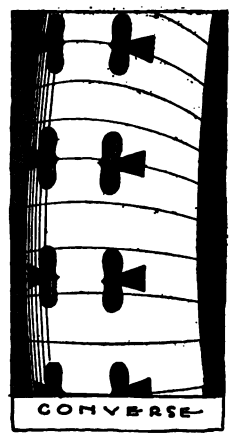
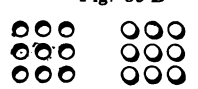


Fig. 39 B

Typical Caulk and Cup Designs



Raised Types

Fig. 40 A

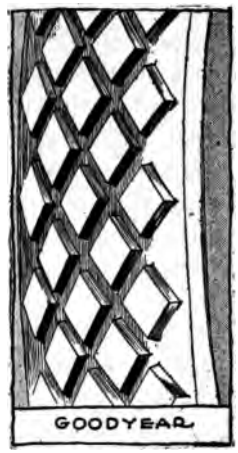


Fig. 40 B

Depressed Types

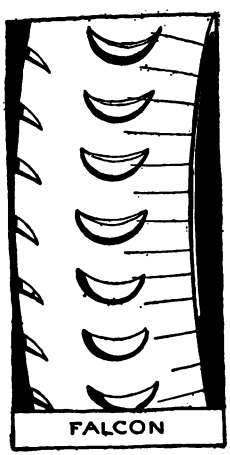


Fig. 41 A

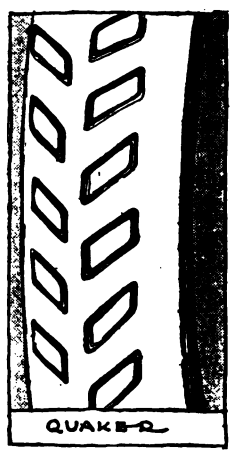


Fig. 41 B

Emphasizing Lines on the Bias

size of the depressions are sometimes so arranged that they give the effect of a raised non-skid type. The writer has therefore classified the types from a purely optical standpoint—the only method available to the average reader. There is little to choose from between the raised and the depressed treads of the best types—for in the case of the latter the tread has received an extra amount of rubber so added to the crown of the tire as to allow for the stock displaced by the depressions.

The tires in group *one* Figs. 34 and 35 illustrate the principal of lines *parallel* with the tread or bead. This is an ideal design for a front wheel, as there are no traction requirements. This type gives maximum protection against side skidding without handicap either to speed, or ease in steering.

Group *two* (Figs. 36 and 37) demonstrates the principle of lines at right angles to the tread or bead. This put an accent on traction, or road grip and must, as is generally the case, incorporate other features to avoid skids to the side. With this type, adequate compensation must be made for loss in coasting ability. (Note how this has been accomplished above.)

Group *three* (Figs. 38 and 39) is a compromise with the two previous types—lines on the bias predominate. It cannot be doubted but what this is an extremely effective type, both in skid and traction values.

Group *four* (Figs. 40 and 41) involves two principles, those in Figs. 40 A and B being the same as used in a hob nailed boot. These types yield a high degree of traction value and are usually accompanied by supplementary designs so as to effect an all around anti-skid value.

Figs. 41 (a) and 41 (b) show the adaptation of the suction principle. Here the situation is reversed as

there is not so much emphasis on traction value, but great inherent non-skid properties. In fact the suction principle yields one of the simplest and most efficacious of all skid preventers and if accompanied by some adequate supplementary design such as Fig 41 B a thoroughly all around Non-skid type is evolved.

Summing Up

There is no vast difference in wear between the raised and depressed types in tires embodying the best design. There is no inherent advantage in either, although there seems to be a slight tendency in the raised type to wear down faster in the first third of its natural life. It is also claimed with some degree of reason that the depressed type is apt to extend its non-skid properties through a relatively longer period. At any rate the majority of non-skid tires have been so skillfully designed that they are good as they can be—as far as they go. Their limit of effectiveness is, however, generally reached at a period ranging anywhere from one third to two thirds of the actual running life of the tire. Some motorists make a practice of transferring the tires at this point to the front wheels—but the front wheels have their limit of capacity so that this cannot always be done. A safe rule for the consumer to follow is to use the best possible non-skids available, on the rear at least, supplementing their use with chains when road conditions are treacherous.

CHAPTER VI

Analysing Tire Costs

Most consumers have a very lively curiosity as to the conditions which bring about advances and decreases in tire prices. This curiosity is rarely satisfied because the dealer himself is not conversant with the factors which govern tire costs. There is a hazy notion that tire prices invariably follow the trend of the crude rubber market, advancing with every marked rise in the crude gum and easing off with every depression. Up to three or four years ago this assumption was fairly accurate—particularly while the other factors—fabric, chemicals and labor tended to remain fairly stationary. In the past few years however a marked change has taken place amongst the other items which govern tire costs so that rubber itself is no longer the dominating factor in effecting price changes.

Distribution of Material

To get at the true inwardness of tire costs we must find out first just what goes into a tire, and what relation each group of materials bears to the finished tire. In the early days of the industry there was a considerable difference of opinion as to what constituted the proper proportion of fabric and rubber to produce the most efficient tire. Some manufacturers believed that a tire composed almost entirely of fabric and with a relatively thin tread and side wall, would give maximum results. Others claimed that the carcass should be subordinated to such an extent that it would have only enough fabric plies to

eliminate blowouts from the air pressure within the tube. Practical experience however has established a fairly uniform formula which is responsible for the well balanced tires of today. Inasmuch as some rubber companies still emphasize certain parts of a tire to a greater extent than others, we must strike an average of the different makes in order to base our estimates of cost with any degree of accuracy. The result of this averaging is shown in Fig. 42 and gives us a graphic idea

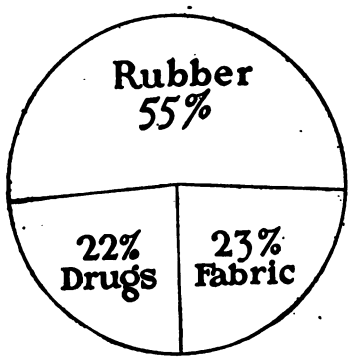


Fig. 42. Approximate Distribution of Materials in Gross Weight of Average Tire During 1917.

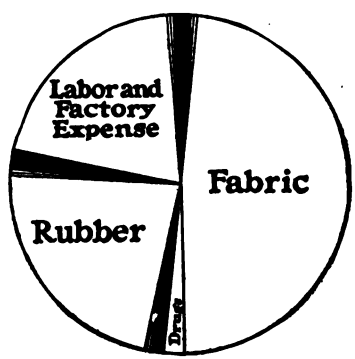


Fig. 43. Approximate Distribution of Cost Items in Finished Tire Based on 1917 Figures.

of the distribution of materials entering into the mass weight of a tire. It will be seen at once that the percentage of rubber is greater than that of fabric and drugs combined. It constitutes slightly over half the mass weight, and the reader will readily understand that with fabric and drugs fairly stationary as they were in the pre-war period, any fluctuation in rubber affected tire costs directly. Rubber was then the recognized barometer of the business and every pronounced change in the supply and demand of it was very surely reflected in tire price schedules.

Distribution of Cost Items

War conditions have however reacted on the tire industry in such a way as to make crude rubber a rather negative factor compared to the feverish fluctuations of other items entering into a tire's cost. Rubber is fairly easy in price and has been so, throughout the period of the war. The supply has been considerably augmented by the normal increase in yield of the plantations, while world consumption of crude gum has failed to keep up with its previous rate of increase. The European countries, while increasing their demand for *finished* rubber products, have no longer available their usual facilities for its manufacture—men are scarce and everything has been subordinated to the production of those necessities directly connected with prosecuting the war. Germany and the other Entente powers have suffered from an embargo that has reduced their consumption to nothing. Thus with a demand somewhat decreased and a supply somewhat increased, rubber has fluctuated very slightly from quotations of 60 to 80c per lb. on best grades. Had it not been for the scarcity of ships and exorbitant marine freights rubber would have dropped well below these figures.

Fabric, the next largest factor in the weight of a tire, we find, has gone up like a balloon. It is usual for war conditions to put an abnormal demand on all textiles and a glance at the chart (Fig. 44) will show an increase of 150 per cent. since January 1st, 1914, while labor has advanced 35 to 40 per cent. since 1916, of which about half has occurred between Jan. 1st, 1914, and Jan. 1st, 1917. The drugs used in curing have also advanced about 100 per cent., but the percentage of this cost item to the whole is normally so small, that even doubling it does not greatly affect the finished tire cost. Most of

the drugs sell now at 10c per lb. or under, which compared to $1.60 per lb. for 17¼ oz. Sea Island duck and 65c per lb. on the best gum, makes the cost item rela-

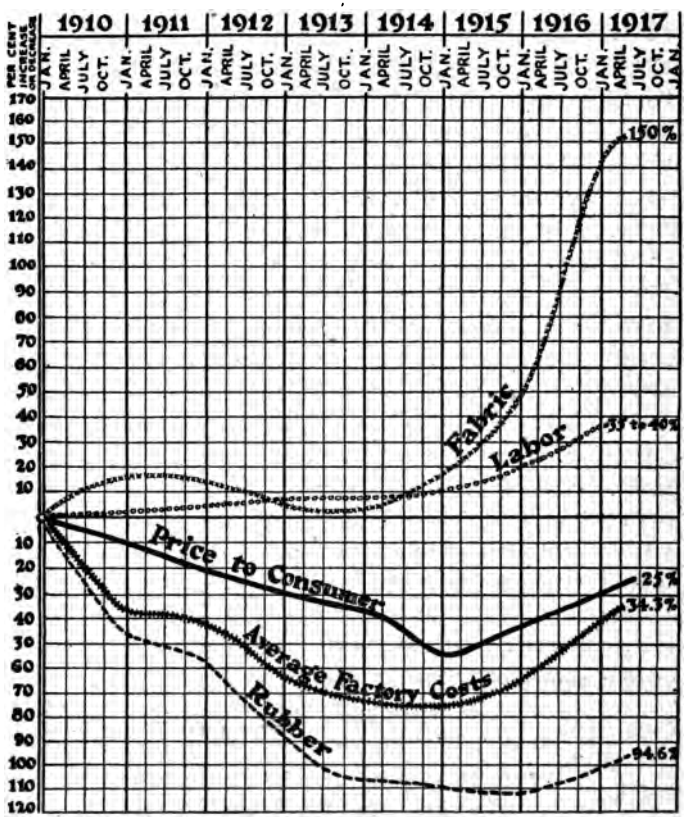


Fig. 44. Relative Changes in Consumer Tire Prices in Relation to Cost of Labor and Materials

tively negligible. The graph shown in Fig. 43 represents the distribution of all cost items, entering into a finished tire. This is done by averaging the figures of several

factories, and in this chart Labor and Factory Overhead Expense must be reckoned with as factors affecting the cost of a tire. These two items vary considerably, due to local and internal factory conditions obtaining in the various plants. Low priced labor under the most efficient management often makes this item the least to be considered, particularly when linked to unusually large volume of production. On the other hand, high priced labor combined with low factory efficiency might make this factor represent as much as 40 per cent. of the making cost, particularly when linked to a relatively small volume. These possible fluctuations of Labor and Factory overhead might alter the estimates shown in Fig. 43 to almost any dimension and the writer has shaded the lines to allow a fluctuation of at least 5 per cent. Nothing but absolute Factory cost has been considered here as the fluctuations in marketing and transportation expense are so vast as to forbid a clear treatment. Note that Fabric, which amounts to about 23 per cent. of a tire's weight, becomes almost 50 per cent of a tire's cost at present quotations. Rubber which represented 55 per cent. of the total weight is shown as being only about 25 per cent. of tire cost, while drugs and tempering chemicals amounting to 23 per cent. of mass weight represent a cost of 2 or 3 per cent.

Comparative Fluctuation

With these basic facts before us we are now in a position to consider the fluctuations in factory costs and consumer's price schedules since Jan. 1st, 1910. A careful analysis of the retail prices of six well known brands, two of which are high priced, two medium and two low priced, gives us an average tire selling price for each year of the period. The figures given are based on a 34 x 4 non-skid:

1910	1911	1912	1913	1914	1915	1916	1917	(1917) May 1st
$47.63	$41.63	$34.45	$34.71	$32.80	$25.87	$28.40	$32.21	$34.61
	— 12%	— 7%	— 9%	— 5%	— 21%	+ 9%	+ 13%	+ 7%

The percentage figure represents the increase or decrease in price—in each case the previous year's price is used as a base. The sum of the decreases and increases during the seven years' period total as follows:

54% decrease
29% increase

Difference 25% decrease

In short we find that tires have had 25 per cent. more of decrease than of increase in this period, which means that tires today (August, 1917) are selling for approximately 25 per cent. less than in 1910. This is astonishing in view of the abnormal increases in Fabric, Labor and Drugs; in fact tires are sold today on about the same average price schedule as that of July, 1912. The answer is obvious—manufacturers are taking a smaller profit but are doing a vastly bigger business. It is an example of the department store ideal of large sales and small profits. Large scale production has brought about greater factory efficiency and lower overhead expense, while rubber itself has eased off from $2.45 per lb. in 1910 to 65c in 1917, thus offsetting to some degree the advances in fabric and labor.

Rendering Unto Cæsar

It is safe to assume that if it were not for the marked decrease in the cost of rubber in the face of advances on all other factors the consumer's tire schedules would have become almost prohibitive by now. As it is, conditions as they exist today prove one thing very clearly and that is that

every advance made so far by the manufacturers in the selling price to the consumer has been amply justified. He has rendered unto Cæsar everything that is Cæsar's —and then some. If the past is any gauge of the future, further advances can be looked for until conditions return to normal for there is no other way in which the manufacturer can keep abreast of rising costs.

CHAPTER VII

Merchandising Tires for Profit

Just Merchandise That's All

A few fundamental principles govern all business transactions. They are all closely related and interchangeable. The best selling maxim I ever heard was this "Know your line—pray unceasingly and work like Hell." It fits every business. After all—tires are just merchandise—subject to the same rules of the game that applies to all manufactured products. The dealer who is starting out to get business on tires would do well to rid his mind of the suspicion that it is either a mysterious or unusually difficult job. Given a definite and increasing market on an article which has become one of the great staples of commerce, surely there should be no difficulty at all in "horning in." It is true that each business has its own "language" its trade patter—and it stands to reason that a little time should be spent in mastering the rudiments so as to be able to talk to the buyer in his own tongue. But he won't need black art or magic, or Rockefeller's commercial genius.

Paint for instance is a time honored staple—this one business is truly representative of ALL business for in it are condensed all the ups and downs, selling schemes, quality differences, price fluctuations and what not that are common to all commerce. Just like tires there are innumerable brands of paint, but they invariably group

themselves into one of three classes: High-priced, Medium-Priced, and Low-Priced. Now it's a cinch that any salesman selling paint will have prepared a logical line of attack, and (assuming service to be equal) his attack will have two prongs. He MUST either talk quality or talk Price. This being the case, his business will tend to concentrate at the two extremes. A vigorous quality talk is only convincing so long as it is confined to high-priced paint—it is wasted utterly on cheaper products. The consumer has ceased to expect something for nothing—two and two tot up exactly four with him, and if a man claims it totals five, he does not warrant serious consideration. So, with the dealer when he makes his attack on a price basis—it's "Quotations" not "Quality" that lands the order in nine cases out of ten. Note that high quality is not specified.

Getting Down to Cases

Every striking sales success has been based on human nature. Human nature when it goes shopping is susceptible to two appeals, Quality or Price. You want your share of both—but above all you wish to achieve the biggest possible permanent success *with least possible continued effort*. Some meet this by a fifty-fifty division of their time and energies, but the far seeing man will invariably give the lion's share of his time to the thing that yields him the most permanent and profitable returns. Quality is always "constructive," builds up and stays built up. Price transactions follow lines of least resistance, are transient—and subject to "change without notice." The quality business yields great dividends in volume and repeat sales—but it takes resourcefulness and hard plugging at the start. The campaign will take hold only in proportion to the steam behind it. and it is here that the enthusiasm and pep born of a sublime confi-

dence in one's product operate to the highest degree. Quality business represents the cream of commercial transactions and no one can rightfully expect to get it with banked fires under the furnace. It takes a full head of steam.

What Does the Public Want

The first element in merchandising involves the selection of the tire or tires that are to be handled. A proper selection probably has more to do with future success or failure than any other factor. It either puts a dealer "in tune" with the buying public or at odds with it. Quoting from the writer's article in the April 19th, 1917, issue of *Hardware Age,* "Tire merchandising to be successful must be based on the immutable law of supply and demand. Demand is of course the expression of what the public really wants—supply is the satisfying of the demand by a service that is more prompt and more convenient than current competition. Any business in harmony with these fundamentals must succeed. The problem then is simply to understand clearly the element of demand, for we can rest assured that the supply will inevitably follow, once the demand is made definite. Unfortunately tire demand is not simple, but complex: as varied, in fact, as human nature itself. For all practical purposes however demand can be separated into two major groups. Bulk human nature responds either to the clarion of quality or the appeal of price, one wants the feel of a few dollars saved at the outset, the other willingly disregards first cost if it means economy in the long run. Here then is the essential tire market—and surely a merchant can ill afford to ignore either end of it. Logically he must strike a balance of quality and price—must gain the exclusive control of both a high and low priced tire.

Protecting Profits Having selected tires that will put him in tune with demand, it is essential that the dealer obtain exclusive distributing rights in his district. The basis of success in quality merchandising is adequate protection. Given "elevated quality" and insurance against "subway competition" then the dealer's profits will be limited only by his own energy. Without protection he finds his market price fixed by his most ruthless competitor to the exclusion of profits. No dealer is justified in giving whole-hearted co-operation toward building a market which he will not be able to dominate.

Fallacy of Price Limits But, says the dealer, it is easy enough to give abstract advice regarding the sound wisdom of concentrating on high quality tires but can one always get away with lofty price schedules which go with such merchandise? The answer is decidedly YES. In the first place higher priced tires are usually the cheapest—in the long run. The consumer actually does nothing else here but buy *more miles at one time* and, as is usually the case with the quantity buyer, he is apt to get a lower cost on each unit, which in this instance is the actual running mileage delivered. Aside from this fact, it's a great mistake to set a mental limit on the price the public will pay for any article. Outside of postage stamps there is no such limit within reason. An article is *worth* exactly what the public is willing to pay for it—and if the distribution (or supply) is restricted so as to form a practical monopoly, this limit is raised to a higher level—a level that shows snug profits for every factor in the transaction. It is well understood that net profits are greater on quality merchandise—there being more "give and take" on cost, also a high price-level which automatically

increases volume of business. The ratio of "repeat sales" is admittedly larger and hence shows a decreasing sales effort and expense. Now these solid advantages are shared in by the Factory Jobber, Salesman and dealer alike; forming a permanent basis for successful merchandising under the most agreeable auspices.

How It Works Out

In every line of business there is some startling example of a manufacturer who has in effect raised his product above competition—that is competition as we know it—special discounts, long terms, and quantity prices. Such manufacturers have somehow gotten their quality taken for granted *in advance* by the purchasing public, and are practically immune from successful attack. Take names like Tiffany, Sheffield, Pierce (Arrow), Banister, Pears, etc., when applied to their respective product, the public accepts it as they would the "In God We Trust" on our currency. Why, some of the older firms today won't use typewriters or telephones—have in fact one foot in the grave and the other on a banana peel—but they have such prestige with the public, that they "get by" on the strength of the name on their product.

A Prophecy

When it comes to tires there are probably not more than two or three brands whose proven quality has given them the bulge on price competition. Yet they *do* exist and the motorist who buys one knows that he has got to "cough up" right smart but he has an accurate "bird's eye view" of what's coming to him in value. Consequently the separation process proves practically painless. Altho the supply of De Luxe quality tires for a dealer's consideration is not large enough to prove embarrassing at this moment, the trend is encouraging and indicates that there is being developed for the modern dealer a wider

selection of tires of supreme calibre. Tires that will be taken at face value by the consumer and on which the demand from the public will actually exceed the supply in at least some measure.

Getting Started

It is the ambition of every manufacturer, jobber and dealer to stand sponsor for a line that sells itself successfully, but the specifications call for a fine co-operation all along the line and a lot of preliminary plugging. Nothing worth while ever gets done without GUMPTION, GET THERE and GUTS. The tire must be fearlessly priced from the very first and not with regard to competing brands, but wholly as regards actual value to the consumer. Beyond that the sales policy must be on a *strictly one price to all* basis, and divorced from preferential deals. As a cap sheaf, the sales policy must insure protection from "cut throat" competition. The salesmen and clerks must resolutely adhere to this too, despite the increasing temptation to develop volume when the tires commence to gain popularity in a district. The whole transaction has just naturally got to be dignified by an attitude that looks beyond the next five minutes.

What Is Profit?

Having made a discriminating selection of the stock, to be handled and having surrounded it with a measure of protection against unfair competition—the stage is set for profits. The vital question remaining is to determine what a Profit really is, that is the difference between *actual* cost and *actual* selling price. Gross profit is the difference between what an article costs and what it sells for. "Net Profit" is this amount less "overhead." Hence Gross profits may be large without salting away a red cent in the earnings column. That retail dealers do not always make reasonable profits is largely due to two

facts (A) ignorance of real cost—that is the proper addition to invoice prices of selling expense and overhead charges and (B) a tendency towards ease rather than effort in merchandising by accepting less than normal profit on tires that come to him half sold through the manufacturer's advertising. In this connection the following article published in *Automobile Topics* is interesting. It was written by J. S. Joslin of Rockland, Ill., and as he is a tire retailer himself, he knows whereof he speaks.

Live Sermon on Tire Profits

Successful Dealer Shows Mistakes Made by Dealers—Overhead Cost Often Prohibitive—Selling Tires May Mean a Loss

"That most automobile dealers and a good many garage men sell tires at such a low margin of profit as to suffer an actual loss on each sale, is the discovery made by Jud S. Joslin, one of the most successful distributors. And the reason is that hardly one out of a hundred know how many tires they sell in a year, how much it costs them to sell them and and how much net profit they make on each sale.

"I have had a lot of trouble finding out what the percentage cost of selling tires is to me, also what the net per cent. of profit is in selling tires. Out of 200 garage men I have interviewed I have found only one who could tell me: and his per cent. of cost was within one-fourth of 1 per cent. of my own.

"Not taking into consideration a 5 per cent. cash discount which may or may not be taken, as it is carried in the Discount and Interest account on our books and is not, or should not be considered in relation to the merchan-

dise profit, if you had paid $18.60 for a 34 x 4 tire and sold it again for $21.35, your gross profit was $2.75 and your gross per cent. of profit was 12.8 per cent. on the list price. But wait, we find that 16 per cent. of the list price is our cost of doing business, consisting of interest on the money tied up in the tire stock, the time required to argue the prospect into purchasing the tire, the cost of a little advertising which may have been done, light, rent and heat in that part of the building in which we are conducting our tire business, with 1 per cent. added for bad debts and collections. If your accounting system shows your cost of doing business you will not allow a discount for cash: you will demand $21.35, list price, and even then lose 3 per cent. Our volume of business, or total of sales, amounts to one dollar to every four inhabitants of the town in which we are doing business. In other words in a city of 50,000 it amounts to $12,500 in sales each year. Apparently, it doesn't make any particular difference in the per cent. of selling cost, whether the volume is $5,000 or $20,000 a year the cost percentage decreases according to conditions. One of the largest tire manufacturers in the country recently told me there was a very nice profit in selling the so-called fair-priced tire, the idea being that if you get volume enough you could decrease your overhead expense to as low as 10 per cent., providing you sold $60,000 worth of tires in a year. *This is preposterous for most of us you see.* It is not unreasonable to suppose that with a 16 per cent. overhead on yearly sales of $10,000 to $15,000 that this overhead could be reduced to, 10 per cent. on a $60,000 volume. But, do you believe that the profit is sufficient even with a 10 per cent. overhead? At that it would net only 2¼ to 3 per cent., and that certainly is not enough.

"The tire manufacturer is not to be blamed altogether for present conditions. Only a few years ago, there was a gross profit of 25 to 29 per cent. on tires: and that looked like so much money the majority of garages insisted on giving some of it to the customer. Then it wasn't long before the manufacturer assumed the attitude that he might as well give it directly to the consumer himself instead of troubling garages to do it.

"A garage with a 16 to 20 per cent. operating cost, which is a fair average, is only receiving a discount of from 12½ to 13 per cent. on its tires, and 18 to 22 per cent. on its regular automobile and garage purchases. Do you think that despite that, you can afford to cut prices? The real reason why this condition exists at all is the lack of known costs."

The Answer

How is the dealer to dig himself out of such a situation? In the first place if he is following the best merchandising practice of carrying both a high and low priced tire, he must analyse the part he expects each to play in furthering his interests. If the rate of net profit on each sale was the sole consideration a dealer would not be forced to carry two lines, but it must be remembered that the number of sales made, (or volume of business) is of vital importance. While the exclusively controlled premium tire will yield large intrinsic profit, it is limited in appeal to only a part of the buying public. In these highly competitive times a more general appeal must be made in order to attain the volume required to cover cost of doing business. Figuring from this angle then the dealer would look to cheap or medium priced tires for the volume sufficient to carry overhead expenses of his tire department. The cap sheaf of his net profits, then, would come from the high priced line of tires and his

specialties in the accessory lines—many of which show a gross profit considerably in excess of the 18 to 22 per cent. indicated by Mr. Judson, and are especially profitable as a consequence. To illustrate, let us suppose a dealer's general cost of doing business on all lines and including his own salary, is 16 per cent. and his total yearly volume of sales is $50,000 divided roughly as follows:

Low priced tires	$18,000
High " "	12,000
Accessories, etc.	20,000
	$50,000

At 16 per cent. his cost of doing business would amount to $8,000 and any surplus over this sum after all monies are paid would represent the net profits over and above the dealer's legitimate salary. Let us see what each branch of the business can be expected to contribute towards wiping out the $8,000 and establishing a margin of profit. In the first place each division will show a different actual cost of doing business. As Mr. Reynolds of the United States Tire Co. has well said (February *Hardware Review*) "He (the dealer) sometimes thinks there is insufficient profit because when he figures out in percentage the amount of profits returnable on the sale of tires and the average percentage of profit on all the other lines, the percentage comparison is unfavorable to tires. This method of determining the value of merchandising is a very unsatisfactory one.— Lumping of costs, lumping of profits, lumping of turnover, are also deceptive in themselves when figured strictly on a percentage basis and it is absolutely necessary for the dealer to adopt a plan of making all of the merchandise which he sells

proportion unto themselves their proper share of the cost of selling, the cost of shipping and every other item of cost distribution." This is absolutely true for there are wide variations in actual overhead cost between the different classes of merchandise. For instance the accessory department will depend on a vast number of sales in relatively small amounts hence the selling expense in this department will be large. These goods too will require a larger storage space in proportion to business done and cannot be expected to yield the same turnover as tires. The average accessory lasts the life-time of the average car as in the case of tools, pumps, jacks, shock absorbers, fire extinguishers and the like. For this reason "repeat sales" are necessarily rare, whereas a motorist consumes his tires with the same regularity that he does gasoline and oil. We can safely assume that while the gross profit on general accessory lines may be high as 33 per cent., the cost of doing business is also high, at least 5 or 6 per cent. greater than his average cost—say 22 per cent. His tires on the other hand would cost less than the general average. His minimum tire sale would average over $20.00 at present quotations while he should turn over his stock at least five times per year—probably more. Practical experience backed by actual knowledge of costs has in fact demonstrated that 10 per cent. is a fair charge against the tire overhead of a well balanced and well regulated business.

While these figures are reliable and conservative as far as they apply to the cheaper tires, they should be revised in the case of the higher priced tires for these reasons. The cheaper product appeals to the multitude, those who either cannot afford "long run economy" or those who are yet unaware that the best is always the cheapest. On account of this tendency less initial sell-

ing effort will be consumed in gaining the desired volume on lower priced brands. Then too, the cheaper tires as a rule are given a larger national publicity by their makers, which removes from the dealer an appreciable burden of selling. The necessity for this is obvious, as the tires themselves seldom achieve such remarkable results as to absolutely assure repeat sales and so must be stimulated artificially. The dealer of course must contribute his share to this expense, but it is not large and can be done in the aggregate by the factory with far better results than possible to him as an individual. Let us assume then that the dealer's overhead cost on his cheaper tire product is 10 per cent. against an average gross profit of 15 per cent. and on the higher priced tires, an additional charge of 5 per cent. is placed to cover the expense of a concentrated selling effort by the dealer in their behalf. This gives us a charge of 15 per cent. against an average gross profit of 25 per cent., the latter representing the difference between the consumers' list price and the cost to the dealer—exclusive of cash discounts.

We have previously ascertained general overhead cost being 16 per cent. of $50,000 or $8,000 per annum. Taking the above factors into consideration then the distribution of this cost figure would be about like this:

Volume		Overhead charge	
$18,000	Low priced tires	10%	$1800.00
12,000	High " "	15%	1800.00
20,000	Other lines	22%	4400.00
	General Overhead 16%		$8000.00

Now that the "Overhead" is accounted for let us take up the profit:

	Gross profit	Overhead	Net	
Low priced tires	15%	10%	5%	$900.00
High " "	25%	15%	10%	1200.00
Other lines	33%	22%	11%	2200.00
		Net profit		$4300.00

or 8½% on total business.

These figures are arbitrary of course, but they are in harmony with actual conditions, and are being approximated by many dealers in actual practice. Mr. Joslin has given us the amount of his business but not the distribution of his cost items, applied to his various lines, still it can be seen that tires are a considerable factor in his business and in spite of the discouraging figures he quotes, the big essential fact is that he is successful and making money. Most failures think they are making money when they are in fact losing it—while Mr. Joslin belongs to that type of successful business man who feels that a business is always losing money unless figures absolutely disprove it. In his instance it seems likely that the figures given are the result of "lumping" all items of cost and profit instead of distributing them equitably, particularly with reference to individual cost and individual turnover.

"Seconds and Gyp" Tires

It is barely possible that the writer's use of the phrases "cheaper tires" "low priced tires," etc., may lead the reader to assume that "seconds" and anonymously branded products are to be included as a legitimate part of his stock. This misconception would work out seriously to his disadvantage for there is absolutely no place for such goods on the shelves of a reliable dealer. It is true that many factory seconds manage to give a good account of

themselves, but it is more by good luck than good management. It can be taken for granted that no factory will assume an actual loss on its product unless something is so radically wrong with the product as to justify the step. Most factories take the precaution of buffing off their brand name so as to lose all identity with it. In short they take the loss and wash their hands of the transaction. So despite the occasional value offered in factory seconds, the matter is too much of a lottery to warrant the risking of a legitimate dealers' prestige and his established good will. Good Will is really the undivided surplus profits of his business and his insurance policy for future profits—he cannot afford to jeopardize it. The so-called "Gyp" tire is well described in a recent editorial from the New York *Journal*. "Among automobile men the tire with no name, the tire which tells you it is good—but doesn't prove it—the tire that you never heard of before, the 'chauffeur's graft' tire —all such worthless stuff is known as the 'gyp' tire. The 'gyp' tire is named for the 'gyp' horse, the latter being the horse that you buy of the gypsy. All gypsies have horses for sale. You see them at the roadside, the horses picketed, sad and thin. Each gypsy can tell you wonderful stories about the merit of his horses. But the wise farmer buys no 'gyp' horse. He knows that next morning, when the horse is lame, the gypsy will have disappeared. The wise buyer of automobile tires buys no 'gyp' tire. For if you buy a horse from a gypsy, you at least get a horse. He has four legs, some kind of a mane and tail, and usually at least one eye. Even a gypsy when he sells you a horse must sell A HORSE of some kind. But the maker of 'gyp' tires can sell you anything or nothing. You haven't X-Ray eyes, you cannot look on the inside, you cannot know whether what

you think is rubber really IS rubber or a mixture of rubber and something else. You cannot tell whether the fabric which is to the tire what your muscles are to the body is intended to wear or WEAR OUT. Back of every tire worth while there must be an honorable name and a great organization, for it takes great factories great buying power, expensive machinery, a well established industry to produce a tire worth buying. Every tire that is worth while has its reputation, its name—IT IS KNOWN. The man using his eloquence to persuade you that some unknown tire is a better bargain than a real tire, is simply using his eloquence to cheat you. If you doubt this, listen to the experience of the writer. One of his friends is manager of a great concern that sells automobile bargains. This friend showed the writer thousands of tires, all of different kinds, or rather INDIFFERENT kinds. They were piled up ready to be sold. All nameless. Extraordinarily low prices were quoted. This writer said to his friend, 'If those prices are really as low as you say, let me know which is the best of these bargain tires, so that I can get them instead of the more expensive tires that I buy.' 'No,' said the dealer in 'gyp' tires, 'YOU don't want any of this stuff. You wouldn't get satisfaction. Continue buying what you have been buying, one of the well-known makes. Nothing else would suit you.'

"Mr. Reader, buyer of tires, nothing in the way of a 'gyp' tire would suit YOU either. You wouldn't buy a solid gold ring of an unknown peddler if you had no way of testing the gold. You would be suspicious of the man who offered you solid gold less than the price of solid gold. Be suspicious of the tire man who offers you solid rubber, high class workmanship in fabric, for less than the natural price of solid rubber and cost of

high class workmanship." There is a legitimate place for the cheaper tires legitimately cared for by factories capable of production on a large scale. They produce standard products whose price schedules are well down in the list of KNOWN merchandise. The public demand is always reflected in the barometer of business, and if there was no specific and continued demand for something else besides De Luxe tires, the great and successful tire companies would cease to make them. As a matter of fact in practically every instance good value is given for the money and the merchandise is backed up by the maker's name in every sense of the word. The difference between low and high priced tires is that the former is apt to be a retail purchase of mileage and the latter a wholesale purchase.

The Higher Balance

So far we have been considering tires almost wholly from the dealer's standpoint—it is just as well however that we get a "bird's eye view" of the other factors in the business. We hear a lot these days about Balanced tires. It's the common term for a technical harmony in the assembly of the tire itself and has been heavily featured by a prominent tire company in the past. It is true that any tire achieving road success must have balance—the carcass tread and bead must work together perfectly. There is, however, a larger balance to be struck—a balance of profit and contentment between the factors that dominate the distributing end of the business. Leaving out the manufacturer—all Tiredom is divided into three parts, the Jobbing-Distributor, Dealer and Consumer. Each depends wholly on the others for success. If a proper balance is not struck between them, the whole selling scheme falls of its own weight because no permanent commercial success has ever been established where com-

plete harmony did not exist between every factor involved. A chain is no stronger than its weakest link, so the problem is to yield to each according to his merits and necessities.

The Jobber and Dealer are two hearts that beat as one—they both demand maximum profit and turnover combined with economy of sales effort. The consumer has an eye single to low cost per mile, efficient service, and a square deal.

As between Jobber and Dealer it must be observed that as cost of doing business is higher he should attain a higher rate of turnover—which he does by letting the jobber carry stock for him to a large degree. Remember too that a dealer is on the firing line—he has to look his customers in the eye from day to day. Any tire that fails in performance to an extent that makes "repeat sales" improbable, will force him to change horses regardless of what the profit and turnover may be. Right here Quality becomes a vital factor in the transaction. Any noticeable absence of it, therefore, sentences both the Jobber and the Dealer to the loss of a customer.

Consumers Hold the Whip

In the long run, Mr. Consumer holds the whip hand—he is individually little but collectively *loud*. With nearly 100 competing brands on the market he can be as fussy as he chooses—anything that wins his permanent affection has got to be right there seven-ways-for-Sunday. Nothing short of ultimate *low cost per mile*, prompt service and a cast iron policy of "make good when the tire doesn't" will keep him in line for a dealer.

How It Works Out

In harmonizing the aspirations of each factor it is well to remember that there is just so much to be divided, and if either Maker,

Jobber, Dealer or Consumer gets more than is coming to him, it will be because some one else is getting less—and Business will not countenance any such arrangement any more than Nature will stand for a vacuum. No one can get more than he pays for, and in the long run there is a rendering unto Cæsar of *only* that which is Cæsar's. As an evidence of this let us take for example three typical tire proportions as they have been actually worked out by the dealer. His name and the three brands carried cannot of course be quoted here—but the instance is actual. He has a low priced tire warranted 3,500 miles, a medium priced tire with a 5000 mile guarantee, and a high priced handmade tire carrying a 6000 mile warrant. Taking the 30 x 3½ Non-skid tire as a basis and at prices current in February, 1917, we were able to get a line on just what the dealer and consumer have coming to them—the one in profit and the other in actual mileage cost. The four cardinal factors are Mileage Warrant, User's Price, Users' Cost Per Mile, and Dealer Profit. The Mileage cost is obtained by dividing the user's price by the gaurantee and represents the most the user will pay for his mileage—although in the above instances the tires were all averaging something better than their guarantee and hence yielding lower mileage cost than estimated. Here are the figures:

Warrant	Price	Cost Per Mile	Dealers' Gross Profit
3500	$15.55	.0044	12½ and 5% Cash
5000	19.65	.0039	20 " " "
6000	22.20	.0037	25 " " "

It is not probable that so perfect an example of harmony between Cost and Value received will be often encountered—but it is a fact that for each additional dollar paid for tires of known calibre there is a dividend

received which increases by geometrical rather than arithmetical progression. If there exists sufficient "give and take" between cost and price, the manufacturer can build up to quality rather than down to price and concede to the dealer a better return for his labor and to the consumer a bigger value on his investment.

Keeping Stock

The actual details of keeping a tire stock are largely mechanical—but a well ordered stock is of the greatest benefit to the selling end of the business, hence this detail should be brought to a high degree of perfection. Aside from the beneficial influence that a well balanced stock exerts on sales the dealer must consider its effect on profits. It is only by turning the spot light on the inventory that he can realize the ambition of every good merchant, viz., to have his sales large and his stock low. This can only be done by vigilance all along the line. Stock orders must be placed exactly in harmony with demand as to types and sizes and care must be exercised that any peculiar local conditions effecting demand are taken into account. For instance if in addition to the inevitable Ford business the Dodge car has attained great local popularity—then your order must emphasize the 32 x 3½ Straight side. On the other hand the Overland car may predominate and the 33 x 4 must be accented both on Straight side for present models and Q. D. on the previous ones. As opposed to the haphazard, hit-or-miss way of ordering and carrying stock there is a way open to the thoughtful dealer which will yield him large dividends through keeping his stock worth 100 cents on the dollar and ready for any reasonable demand on it. Efficient merchandising is the very back-bone of commercial success.

A little close study of the figures given in Chapter III,

page 40, will reveal the previous percentages on the total models as to size and type and the tendencies of the future. A study of the *actual* equipment of individual cars as suggested in Chapter XI will act as a check against theoretical error, and correct the data so it will apply to local conditions. The reader can easily keep a chart showing car equipment up to date, as the "Tire Rate Book," *Motor World, Horseless Age* and other periodicals publish complete lists, not once but several times each year. The first essential operation on receiving stock is to establish the identity of the tire as given by the maker through serial numbers. This is of vast importance as it enables the dealer to sell his old stock first, while his records will show the purchaser of the tire and the date purchased—useful indeed should adjustment be asked for subsequently. There are many systems of keeping track of the individual tire—one of the best being that of Mr. George Baker of the Alling Rubber Co, New Britain, Conn. In a letter to the *Stewart Lever,* July issue, he describes it as follows:

Tagging Tires for Stock

"On receiving tires for stock we fill out the tag (see Fig. 45) leaving vacant DATE SOLD, SOLD TO and ADDRESS. The bottom part of the slip is torn off and placed in a file. This (Tag) gives in concrete form a record that can be referred to immediately to find out if a tire of any particular size or make is in stock. The balance of the tag is tied to the tire and when that tire is sold the second section is torn from the tag, then filled in with the DATE SOLD TO and ADDRESS. The remaining part of the tag is left on the tire for the purchaser. The parts of the tag with complete record are kept on file thus enabling us to determine at the end of the year our exact tire sales, with a record of who they were sold to, so that the purchasers

can be followed up for further sales." The best system of keeping tabs on tire stock is that one whose simplicity

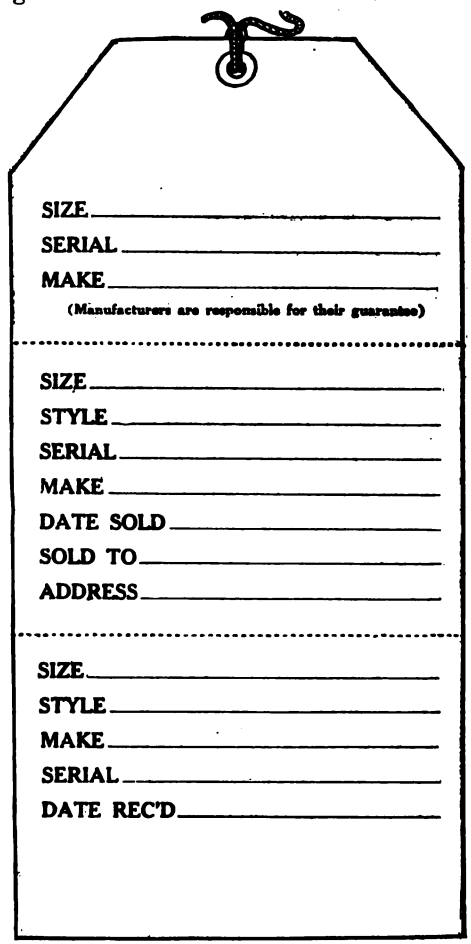


Fig. 45. Tagging Tires for Stock

makes it the most liable to be kept up scrupulously and without fail. With the system above the entire stock can

be carried in a card index divided as to the different brands carried, and sub-divided into Non-skid and Plain tread divisions with a further subdivision as to Bead type and sizes. The bottom slip when filled out can be placed in the proper division thus affording full information at a minute's notice. Little red stickers can be attached to the stubs whenever the tire in question has remained in stock for an abnormal length of time. This will help the clerk in disposing of old stock first, so as to keep a clean assortment on the shelves.

Racks afford the most convenient form of stock containers—so placed as to show only the tread of the tire. Arranged in this compact way a large amount of stock can be condensed in a small space, and this can be further attained by having the racks arranged in double tiers. The stock should be arranged with the same system of division and sub-division as appear in the stock card index so as to avoid errors in filling orders or in making inventories. It is wise to keep tires removed as much as possible from artificial heat and it is a good plan to keep them wrapped in paper just as they come from the maker. Remember that any heat sufficient to unpleasantly warm your hand will have a very bad effect on a tire, particularly if unwrapped and subjected to it for long periods. In this connection, however, many dealers suffer from an exaggerated apprehension as to the deterioration in a tire's quality while in stock. If the tire is right to begin with and given reasonable consideration it should suffer no appreciable depreciation for several years.

Cash Discounts

It is customary to concede the dealer a 5 per cent. discount in return for a prompt settlement of his account. It is hardly necessary to point out how essential it is, that the dealer

take full advantage of it. In the instance quoted before in this chapter the taking of this 5 per cent. on the total business done would yield an additional $1,300, quite a snug little sum in itself. The business man often prefers to carry this discount, when taken, in a separate Discount and Interest account, particularly where he borrows from the bank in order to meet payments promptly. But in this case the difference between what he actually pays for the money and what he sells it at, shows a handsome difference in his favor. There is a tendency on the part of a majority of dealers to pass on to their retail customers a similar cash discount of 5 per cent. even where they have not been able to take their own cash discount. This of course violates the fundamental business principle that a thing shall always be sold for more than it costs—for the discount has actually been *purchased* by the dealer for services rendered. In the case of a dealer who fails to take his discount and who then passes 5 per cent. on to his customer, an actual loss is suffered—and in some instances this discount is conceded not for cash but purely as a "trade discount." Such instances are responsible for the lukewarm attitude of legitimate business men towards the tire business. That these discount abuses are not a necessary part of the business is proved by the fact that there are numerous examples of successful merchandising based wholly on *quality, service* and *square dealing.* It is a question whether or not discounts are of any permanent value in holding business—certainly a business depending in any measure on this feature can be wiped out if a competitor concedes a better discount—and it profiteth very little if this competitor meets bankruptcy at some later date.

There is no doubt but that *service* in the larger mean-

ing of the word, is the rock upon which the most lasting business edifice is built. Particularly service which, in addition to the fundamentals, looks to the small details. Good will, when established is a powerful factor for success—it is a veritable shield and buckler in combatting the sinister influence of the "cut throat" or his well-meaning brother, the business blunderer.

In such instances, wherein sound judgment demonstrates the real need of some artificial stimulation to sales, let it at least have a reasonable leg to stand on. One way would be to offer a useful article from stock and these premiums could be limited to merchandise selling at retail for a dollar or less. The writer remembers a successful bid for business based on the free gift of a pressure gauge, for each cash purchase of $20.00 or over. As these gauges stood him something less than 75 cents it can be seen that, taking into consideration sales larger than $20.00, his concession for cash was probably not more than 2 per cent. and he *got the cash.* In this particular instance it was found that the customer actually valued the tangible and useful article given him far more than an abstract 5 per cent. extra from his invoice.

CHAPTER VIII

Marketing Methods

"Getting Them Coming"

A successful business in any line has two separate divisions—the first is somewhat mechanical and has to do with the acquiring of merchandise and the care of it; it includes the selection of proper equipment and the keeping of adequate records regarding turnover and profits. The other division—that of making sales, is abstract. It involves the secret of "getting them coming." The successful selling plans of today are often hackneyed and worn out tomorrow, so that it is here above all that the best brains of the dealer himself must be brought to bear. The best equipped outfit in a town may fail to achieve success if its human mainspring is unable to lift it above the dead level of his competitors. Many a sick business has been revived and made successful by an infusion of new blood and new ideas. The modern business man wins half his battles in his head long before they are applied to practice and it is these ideas coupled with frequent injections of push and "ginger" that bring home the bacon. Personality and originality are the greatest factors in any success, but it must not be assumed that these qualities cannot be developed to high degree by the average man. Then too, ideas are largely common property and there is no reason why the alert dealer should not take for himself those schemes and plans which have proven of worth in other localities. Trade journals are teeming with timely suggestions that

have been tried in the furnace and proven practical. No dealer who has ambition to succeed can afford to do without at least one (if not more) of the standard periodicals. They keep him abreast with conditions and if he will read them religiously from "kiver to kiver" they will often yield a practical idea that will give him a bulge on his competitor.

The Scenario of Success

Tires are after all "just merchandise" and the fundamentals for selling them successfully differ very slightly from the sound rules which govern first-class salesmanship in any line. It hardly seems necessary to enumerate those basic principles upon which foundation the cap sheaf of effective sales campaigns are placed. Industry, Honesty, Intelligence, all these are taken for granted—and to these must be added the other copy book maxims of unfailing courtesy, personal neatness, and an even temper in the face of irritating incidents. Let us assume then that the dealer has all these homely but valuable traits and consider what he must have in addition. We will assume that he has a well balanced and well ordered stock, a good location and knows his merchandise inside and out, in short, the door is open and he is ready for business when it comes. Getting it coming is his immediate problem, and serving it so well that it will continue to come, is his next.

The Mailing List

The first essential in getting started is to know exactly whom he has a right to look to for business and to whom he must address his appeal. This involves what is generally called a "mailing list" but in this connection there are "mailing lists" *and* mailing lists. The most rudimentary is simply a list of the car owners in the local area and it is probable that every dealer acquires

such a list either by observation or by applying to the Secretary of State or local authorities. This is however only a start and is not the sort of list implied here, for

Name F. X Drummond	Car Pierce	Model C-2	1914
Address 185 Liberty St.	Use Pleasure		
	Brand	Type	Size
Mfr's. Equipment	Goodyear Cord	Q.D.C. F	36x4½ R 37x5
Present Equipment	Kelly & Goodyear Cord		
Credit Information	First Class		
Remarks	Quality Buyer - Personal Service Hobby		
	Influenced by Chauffeur Henry Smith		

Fig. 46 A. Prospect Card

SALES RECORD

Date	Brand	Size	Type	Serial	Returned	Adjustment
3/17/16		37x5	QD Skid	458-050		
4/11/16		36x4½	" Smooth	788-290	9/2/16 5500 Miles	Cut Head Repaired 8-2-16
4/8/16		37x5	" Skid	576-310		
4/8/16		36x4½	" Smooth	892-720	8/12/16 4000 Miles	Blowout Replaced at 6/5 Cost

Fig. 46 B. Prospect Card Reverse Side: Showing Sales and Adjustment Record

it stops short of knowing *all there is to know* about the prospective customer. Nothing less than this will serve the purpose, for in no other way can he know whether

to base his appeal on Quality or Price, on Cost Per Mile or Service, and so must generalize and dissipate the force of his argument. The kind of mailing list that is really worth while would be in card index form, and capable of containing all vital information. It would be in such form as to admit grouping for selective concentration and arranged so as to carry a record of the prospect's transactions when he becomes a customer. It is generally more difficult to do a job with thoroughness than not, but in this instance the work can be carried on by easy stages and is not at all difficult to keep up to date. The ideal mailing list, then, would be a card made up somewhat as shown in Fig. 46. The name, address, make and model of car and whether commercial or pleasure, are all given in the records on file at the State Capitol. A letter to the Secretary of State will either bring the list or address of those publishers who compile these statistics annually. Complete information as to type and size of tires as equipped by the manufacturer can be found in current issues of "Tire Rate Book," *Motor World, Horseless Age* and other trade publications. Tire equipment is constantly changing so that a chart kept up to date as outlined in Chapter XI would be excellent. The tire brands used as original equipment can be ascertained by observation or through the local agents of the car itself. This information is of considerable importance in a sales campaign and can be used to advantage as will be seen later in this chapter. The prices on original equipment are of lesser value but if desired they can be obtained through the "Tire Rate Book" which is issued four times per year and kept up to date. Credit information is of vast importance and can usually be obtained from the other merchants of the town or in some cases through

Dun's or Bradstreet's commercial agencies. A satisfactory division would list the prospect as either High—(no limit), Medium ($—— limit) or *Cash Only*. This information on the card itself will make it hard for a clerk to concede credit where not warranted, and thus prevents undue losses through bad accounts. Information as to tires in current use can be obtained only through observation, but a note book in the hands of the dealer, his clerks and possibly members of his family will soon yield a fairly thorough canvass of cars in the local district. This information should be turned in like this—No. A571–62 U. S. Chain Non-skids, 35 x 5 both rears; U. S. Smooth, 34 x 4½ both fronts, etc. The number itself when compared with the registration list will readily yield the owner's name, make of car, and whether it is operated for pleasure or commercial use. Under "Remarks" can be placed any bits of useful information that might have a bearing on making a sale such as the buyer's preferences and dislikes.

The reverse side of the card leaves room for a thorough record of the customer's transactions and in this connection it would be well to transfer the card to a separate list as soon as a sale is effected. This will form a live wire list of actual accounts, and as it is considered easier to get a customer than to hold one, a high degree of concentrated attention should be given to this group of names. Having thus accurately tabulated the possibilities of his district the dealer has before him a selected audience which, if rightfully handled, should lead to a high percentage of results.

Sizing Up Competition

He is now ready for a consideration of his plan of attack, but before doing so he should check up very carefully the advantages and disadvantages he sustains in comparison

with his competitor, considering particularly as to his capacity to meet prices and render service. The "Tire Rate Book" which has been mentioned before is absolutely indispensable in this connection—it gives a complete list of tire manufacturers and their current prices and by reason of its frequent publication is always correct in detail. It is to this publication that the dealer will turn in making direct comparisons as to the list prices of his competitor's brands. Local investigation will readily determine the mileage warrant and also whether Unit Molded, Unit Wrapped or Combination cured. Further local inquiries particularly amongst tire repair shops will develop valuable hints as to whether the tire in question is better than its guarantee or not so good. Now let us suppose the dealer has prepared a list of his principal competing tires, showing price, warrant, and manufacturing methods, together with such facts as to the performance of the tire under road conditions as can be picked up.

Having these facts it will now be possible to make a chart which will give at least a working basis for comparison. This chart will not be absolutely accurate, because tires of the same brand are not always uniform in quality and the tests which they encounter fluctuate to such a degree as to insure wide extremes of mileage. Let the dealer, however, assume for this particular purpose that each tire of the lot is *at least* as good as its guarantee. He will then obtain a *maximum* cost per mile to the consumer through dividing the cost of the tire by the number of thousand miles in its warrant. This cost per thousand miles will be *reduced*, if by care and good luck the consumer obtains mileage in excess of the guarantee, and it will be *increased* if the tire comes to an untimely end through any cause that would justify

the manufacturer to cancel his guarantee. (These causes will be detailed at length in the chapter on adjustments.) The chart when complete would approximate some such form as this.

Premium Make	Brands Warrant	Non Skid 34 x 4	Cost per Thousand Miles	Non Skid 30 x 3½	Cost per Thousand Miles
A	8000	52.79	6.60	....	...
B	6000	55.50	10.00	33.80	6.76
C	5000	38 35	7.24	21.60	4.32
D	5000	36.20	7.94	26.10	5.22
Dealers own	6000	43.25	7.20	25.00	4.16

Medium Priced Brands	Brands Warrant	Non Skid 34 x 4	Cost per Thousand Miles	Non Skid 30 x 3½	Cost per Thousand Miles
A	4000	33.15	7.73	19.40	4.85
B	3500	28.65	8.19	17.10	4.88
C	4000	31.35	7.77	18.15	4.54
D	3500	28.40	8.11	16.70	4.77
Dealers Own	3500	27.85	7.95	16.60	4.74

In the event that the dealer carries but one brand it will not be necessary to make a division as above, but in any event the Ford rear equipment should be included in the analysis as from 40 to 60 per cent. of a dealer's business may be properly expected from this one tire.

Having his principal competition spread out before him the dealer is in a position to pretty well estimate his strength or weakness, and can at once prepare to make the best of the situation. In the chart it would look as though this particular dealer has done pretty well for himself. In the premium field where Quality and Service are paramount issues and price is of least importance, he is in a splendid position.

On the 34 x 4 Non-skid, he is third from the highest priced, and second in low-cost-per-mile comparison. This latter figure he should properly look into with

thoroughness—as it may be possible that the brand which indicates the lowest cost-per-mile comparison is in fact over-guaranteed, that is, barely attains its warrant under the most favorable circumstances. In this event competition from that source need not be seriously apprehended, particularly if the dealer's own premium tire *is underwarranted* and averages well above its guarantee. If the situation is not so fortunate then the dealer has a first-class fight on his hands—will have to make up in aggressiveness and service what his competitor is delivering in solid mileage. The Ford comparison (30 x 3½) on Premium Brands is exceptionally happy in this instance for our dealer has next to the lowest price and is at rock bottom on cost per mile.

In the medium and low priced field the chart when taken alone does not indicate the real strength of the dealer's position—good as the figures are. In both the 34 x 4 and 30 x 3½ comparisons, he is lowest in price, and second lowest in cost per mile. At first blush it would seem that lots of fine business would be lost to the brand which figures out *lowest* in cost per mile. But as a matter of fact the margin, even if it worked out exactly in the case of each tire, would not amount to much as a sales argument. In this group the paramount issue is "What does it cost?" and next to this in importance is the amount of advertising space used in its behalf. Any article that is heavily advertised but remains relatively low in price incorporates a peculiar but very strong appeal. The advertising tends to make the article "standard goods" in the buyer's estimation and his relief at finding the price lower than expected is the "clincher" in many a successful sales campaign. The author has in mind definite instances of situations similar to the above—and in this one, it is well to note, the

dealer's equipment for the premium field is a first-class tire, not very widely advertised, but carrying a good guarantee and rising superior to it. It is no better than several tires in the market, not so good as a few, but its strength lies in the fact that the dealer will never apologize for it. Above all—he can absolutely control the tire in his own locality, fixing his own price and naming it fearlessly. His premium sales, by showing a nice percentage of "repeats" will effect a decrease in selling overhead, his adjustment difficulties will be at a minimum, and with these factors in his favor he can well afford the making of his own market. The situation when well in hand allows him to dominate, rather than be dominated by either competitor or manufacturer. There are of course some other profitable and satisfactory combinations, and if a highly advertised product of sound merit can be obtained involving exclusive control and a snug profit, the very acme of success should be obtained. These instances are exceedingly rare, due to the fact that the manufacturer who has made his product known in every hamlet of the nation quite properly takes the position that he is carrying the greatest part of the selling expense on his shoulders and is inclined to cut down his discounts in proportion.

The sales campaign is now about ready to "boil over"—let us take a final look around the premises to see if the outfit is right up to concert pitch. First impressions are strong ones—they should be turned into an asset wherever possible. The "store front" always exerts a strong influence on the buying impulse—so let's consider that end of the game first.

The Store Front

"Putting up a good front" is plain slang but it means a whole lot. The store with the "good front" has the public half persuaded from

the outset and generally gets a permanent edge on competition. The eye travels to the building first and nothing will satisfy it but paint in good condition, absolute absence of litter and if possible a bit of green grass or a vine or two. These items are little in themselves but it is remarkable how far they go in getting the prospect properly mellowed up. Incidentally the cost of this sort of thing is small—far less than its value. Probably the next impression breeder is the presence of proper side walk service facilities. See Fig. 47. No modern tire dealer can afford to do without a free air outfit and if he is wise he will include a permanent gasoline stand in his equipment, placing it as near the curb as possible. The trade getting value of this useful feature would make it a profitable investment even if the gasoline itself were sold at cost. It is a great help in "getting them coming."

Putting the Window to Work

The dealer who has a window that is "high, wide and handsome" possesses a feature that is worth much fine gold. People have gotten the idea that looking into a window cannot cost anything and may prove profitable—so they are all doing it. In fact a window has ceased to be regarded as strictly a medium for light and ventilation, and has become something to be looked *into* rather than out of. It is a question whether the commercial possibilities of window displays have been fully utilized by the average tire and accessory dealer. At any rate he has failed to give the subject the attention it receives from a majority of merchants in other lines. Even the so called "Price Wreckers" who utilize every square inch of their window space to display a sample of everything they carry in stock fall short of real efficiency. They fail to obtain emphasis on certain lines and arrive at

Fig. 47. Sidewalk Service Facilities

something that is more of a catalogue than a discriminating display. Window dressing has indeed become an art, but a dealer doesn't have to be an artist to get satis-

Fig. 48. Simple and Effective Window Display

factory results. Figs. 48 and 49 are examples of simple but effective displays requiring no special equipment to produce. Either of them can be made seasonable and more timely by putting in appropriate cards and trim-

ming up the window with any one of a variety of Dame Nature's decorations. Pumpkins and cornstalks, with sprigs of evergreen, holly, etc., can be easily obtained, and

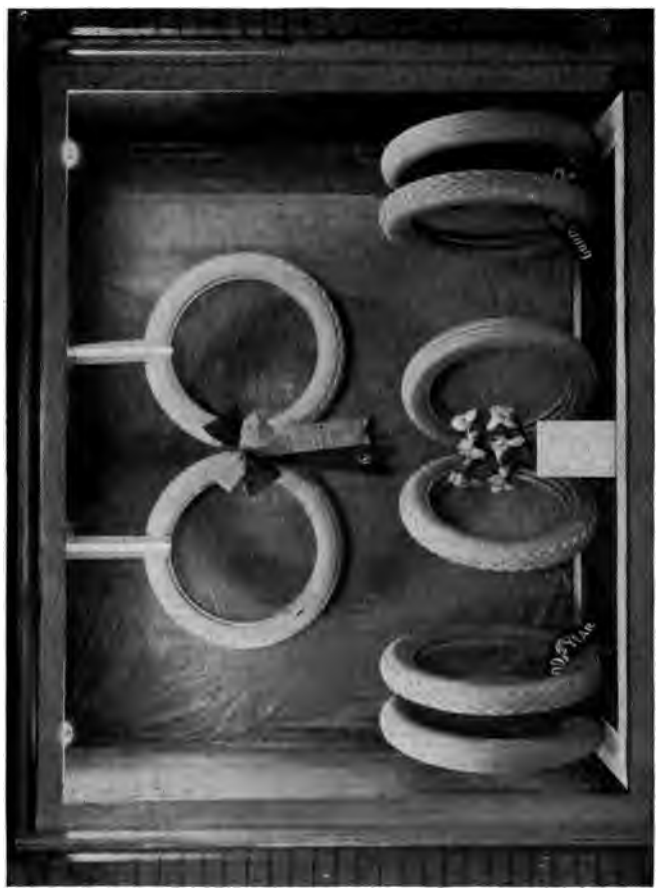


Fig. 49. Another Attractive Display for the Small Window

will do a lot toward linking the display with the season.

A live dealer in a large Southern town worked out a snappy Fourth of July display this past summer by

placing just one tire in his window surrounded by heaps of fire crackers, torpedoes, etc. A card placed in the front of the window read something like this: "THE BIG NOISE IN TIREDOM." Of course the dealer should utilize in full the prepared window displays sent him gratis by his manufacturer, but he should not overlook the opportunity of getting out original work which will reflect his individual personality. The possibilities are endless and a book might be filled with illustrations of what has been done without doing justice to the subject. As a suggestion the experts seem to be agreed that too much must not be crowded into the window at once—and side issues must be subordinated to the main idea. A frequent change of display is essential if public attention is to be held—in fact while both beauty and novelty are desirable—novelty is the greatest of the two. The main object of course is to *interest* the prospect so that this curiosity, if nothing else, will pull him inside. You can't sell him much until this comes to pass.

Inside Hints

Once inside the threshold the odds are all in a dealer's favor—for the prospective customer must, on the face of it, have a need to satisfy or he would have passed on. Here's where that smile and prompt attention and courtesy and all the other Sunday School virtues cash in strong. But suppose the dealer and his clerk are busy already—what is to prevent the customer from suddenly effacing himself, mumbling something about "coming back later" (which he rarely does). This is where inside equipment comes in. To begin with the place should be just a little more comfortable than the street that he came from, warmer in winter, cooler and shadier in summer. There should be one or two comfortable places where the "excess purchaser" can rest his bones and if by some

strange chance a bit of selling literature or an attractive sample should happen to be close to where he is seated,

Fig. 50. The Silent Salesman

not a bit of harm would come of it. Good clean varnish and paint, a few well chosen show cases for accessories and a visible stock of encouraging proportions—the

whole backed up with scrupulous neatness—makes a combination sure to overpower all but the most confirmed grouches. In selling tires the human eye can be utilized as an ally of no mean strength. For instance the tire shown on the "Silent Salesman," Fig. 50, looks exceptionally rugged and unusually large. Now while the tire is all right, it owes a great deal to an effect that is largely optical. The wheel and rim is a standard 34 x 4 outfit, but the tire itself is an oversize, 35 x 4½, giving a logical impression of extraordinary bulk. Aside from this feature it is a well known fact that mechanical apparatus—particularly the sort that will permit of turning—arouses in the human breast an almost irresistible impulse to manipulation—and this is one of the processes that will keep the prospect happy and contented until the dealer can line him up. Another "holdfast" is the stunt of fastening some heavy weight such as a motor cycle to an inner tube and suspending it from the ceiling. The holding strength of a tube after the slack is taken up is really tremendous and such stunts as these never fail to arouse the most flattering impression. Another scheme is to inflate a tube to a little less than its bursting capacity—the effect is startling to say the least.

Price Tagging

A little attention to the arrangement and tagging of merchandise on display is now in order. In this connection it seems certain that the "one price" store has come to stay and our dealer would do well to tag every article in stock having its selling price distinctly marked on it. Let the first price be the *last price,* for fluctuating prices invariably imply fluctuating qualities. It is customary with many successful dealers to use a code form which will not be understood by the customer—particularly where the cost and selling price are both tagged for the

benefit of the dealer or his clerk. If the dealer will put himself in his customer's place he will see at once that this puts a sort of barrier between buyer and seller. When a customer sees a tag bearing some such intelligible symbols as XCF and BHT he forms a lively suspicion that the dealer is hiding something from him. In fact the dealer might just as well say "One of these figures is rock bottom—my minimum in selling—and the other is the price I am going to try to corkscrew you into paying. If I can't get my top price, then it's up to me to get what I can above my actual figures." Of course the customer will resort to every device possible to bear the price down and the whole transaction becomes a haggle—during which good will and confidence fly out of the window. The proper place for cost records is in the dealer's books and while he is quite right in keeping them to himself there is no necessity of flaunting such evidence in a customer's face. The price itself should be carefully determined after due consideration of every expense which enters into cost of doing business. Where possible the manufactures consumer list should be adhered to—but in the end the dealer's own judgment as to cost—(plus profit), and the *value* of the tire itself should be the determining factor.

Right here it is well to remember that while many tires are worth less than their list price and are intended to be sold at a discount, other tires are actually worth more than their list. That is, their ability to deliver value as compared with local competition justifies their being sold at a premium and without discount of any kind. The real value of an article is reflected by what people are willing to continue to pay for it. Whatever the price is, it constitutes a pledge between a dealer and himself and should not be lightly disregarded. He

should be as proud of his price as he is of his merchandise. The customer rightly takes the attitude that a dealer who starts in by breaking faith with himself, will not hesitate to go further and break faith with his trade. Ask a *firm* price and a man will be apt to judge the tire by the valuation *you* put on it. Quote him a soft price qualified by concessions and he will form his own conclusions.

Imagination and Resource

Many successful salesmen consider the price factor as a small thing in making sales. With them it is a sort of afterthought to be adjusted while they are wrapping up the goods. Their method is to arouse an irresistible interest in the article itself by creating around it an atmosphere of its own—by investing it with a distinct personality. A resourceful dealer will find innumerable "Talking points" that soak in deep—he uses a cross section to illustrate his remarks and preaches a live sermon on the good values built into the tire. This kind of selling attains the dignity of an art and elevates the transaction to a higher level than merely "so much for so much." This kind of salesmanship linked to intelligent service puts a dealer beyond the "Me too" class and actually *creates* business. Surely the whole duty of a merchant lies far beyond the mere supplying of a parrot-like demand. Sooner or later a dealer must determine which it shall be for him, a hand on the throttle or a seat in the caboose—for in these piping times a man either *Pulls* or gets *Pulled.*

With the stage all set, the dealer is ready to raise the curtain and start the show as soon as the audience arrives. It is well now to consider carefully the methods most likely to "get them coming" and the first thing to consider is the amount of ammunition the dealer can afford to expend in going after his public. A good

method is to figure what percentage of the net sales can be permanently disbursed for publicity of all kinds, then estimate as conservatively as possible the total business to be reasonably expected the first year—cut this figure in two so as to be on the safe side and apply the percentage figure to it. For instance if the advertising percentage is to be 2½ per cent. and the sales estimate $50,000 on all lines, then the net sum for advertising and publicity would be 2½ per cent. of $25,000 or $625.00. This sum should be further divided in proportion to lines to be emphasized, that is if tires and tubes are expected to furnish the bulk of the total volume, then $500 would be the sum set aside for tire publicity. Right here the dealer should consult with his manufacturers and jobbers as to the amount of help they are willing to contribute to his campaign. This help will be expressed either in literature, "dealers' help" demonstrations, direct mailing list work, or pro rata payments on the cost of original newspaper and billboard work (or combinations of several forms). This cooperation should be carefully listed and where proportional costs for original work are granted by the manufacturer an estimate of the amounts in dollars and cents should be added to the sum set aside by the dealer. The next step would be to divide the sum by twelve so as to arrive at a "budget" for each month's expenditures. For instance if the total sum of $500.00 be increased by factory cooperation to $750, then the monthly cash tire disbursement would be $62.50. This sum in turn would be subjected to an increase or decrease according to whether it was less than, or exceeded 2½ per cent. on the previous month's sales. This is a "safety first" method and very valuable in adjusting the advertising expense to a rational relationship with the total over-

head. It must be remembered, however, that well placed advertising is in part an investment as well as expense and for this reason the dealer would do well to "loan" the advertising account a part of his original capital at the outset, making it pay back the amount in instalments when the business reaches a wholesome volume. Blazing the trail is generally the hardest part of the work—a good general wants his reenforcements *during* the battle, not after it: just so with publicity. At any rate the sum once determined must be adhered to resolutely, and before a nickel of it is expended a division should be made as between monthly amounts for direct mailing list work, billboard or sign publicity, and newspaper space; and a definite campaign laid out for each. The mailing list is by far the most important and should be studied first. Let us return to our previous discussion of the complete mailing list Index cards.

Getting the Most Out of Mailing Lists

We will assume that the dealer has tabulated 500 carefully selected names and has filled out his cards so as to detail all possible information. His next concern is to form a line of communication with them that can be sustained constantly and at regular intervals of not more than one month apart. In figuring out the cost of reaching each name, the dealer should figure postage, stationery and printing, allowing however for the fact that a large portion of the matter will be descriptive literature and price lists furnished free by the jobber or factory. Sometimes this will even include stationery. If he allows for a 2 cent postage every time, with return stamped postal enclosure every other time, the postage cost per month would be $12.50. A fair estimate for stationery, including such as might be furnished gratis, should not

total over 1 cent per name, while printing and form letter costs, in excess of factory literature, could be safely estimated at ½ cent. This makes a total cost of 4 cents to reach each name once, or $20.00 per month. The enclosure of a stamped and addressed post card is very useful when announcing special sales or bidding for mail orders. It will prove valuable as an indication of such names on the list as are especially "live" and a check mark should be placed on the index card for every direct response received. We have now allowed for $240 per year on mailing list work and the question of road signs, illuminated signs and billboard work is open for discussion. This is a field that can be enlarged in scope with assurance of returns but when done thoroughly it requires considerable outlay. The dealer who is feeling his way would do well to limit his work in this direction to putting up such road signs as are furnished him gratis, together with such other signs as can be placed without rental and which involve only the cost of erection. Ten dollars a month would be a fair sum for a starter and this could be increased very considerably as the business enlarged. The appropriations now total $360 and the remainder is available for newspaper work. Assuming that our original budget of $625 had been increased by $375, received from jobbers and factories as cooperation—either by cash or special discounts, there would remain $655 for newspaper work, or $54.50 per month. The best way to distribute this would be to take it up with the newspaper direct, letting them submit yearly or half yearly space contracts so as to get the best possible rates. Their advertising departments are well equipped to give sound advice as to position, and fluctuations which have a bearing on the amount of space to be utilized at different seasons.

There remains only the subdivision of the budget into amounts to be spent on each class of stock so as to harmonize it with the total estimated business. The mailing list should be sent out regularly and many dealers have them made up in the form of timely bulletins, that will keep the prospect in touch with the dealer's merchandise, service, and values. Here are a few:

CAMPAIGN ONE

Title

"Getting the most out of your tires.

Matter

"Buy good tires to start with—(quality talk on dealer's brand). Proper inflation (mention of dealer's service—free air, etc). Care and repair (tire kits and dealer's repair department). Frequent inspection (free of charge by dealer)."

CAMPAIGN TWO

Title

"Buying Mileage—or Just a Tire?

Matter

"It's not the tire itself but the mileage it yields which determines good value. We would be glad to figure our —— tires with you on a cost-per-mile basis. A little conference with us will cost you nothing and may point out a snug saving."

CAMPAIGN THREE

Title

"Out in the Open.

"Some guarantees leave the purchaser hanging in the air—but the —— mile warrant on —— tires is

really an underestimate of their value. Out on our open roads they are making tire history. W. J. James, 6,800 miles, H. I. Carter, 7,200 miles, Crystal Ice Co (commercial), 6,500 miles, F. B. Taylor, 8,300 miles and *still going strong*. These are but a few nuggets from our mine of value. Let us figure with you next time."

Winter Business

These bulletins can be carried on indefinitely, varying with the seasons. The Sedan, Coupe, and Limousine owners should be approached all through the winter—their seasons is the reverse of the ordinary purchaser. The note book should be brought into play again and every report showing worn out tire equipment should bring a personal letter calling the owners' attention to the matter in a tactful way—and emphasize the fact that the dealer has the exact size in stock and giving price and guarantee. In this connection most commercial cars are in use throughout the winter and there is a gold mine in it for the man who prepares himself to go after it energetically. Any man can sell goods *in* season, but it takes a merchant to sell *out of it*. This is one more instance of the value of a discriminating mailing list—there are many more of course.

Utilizing the Ill Wind

Earlier in this chapter mention was made of the advisability of including on each index card the brand of tires with which the car was originally equipped by the manufacturer. This information is of course of real value—as in gunning for business, a knowledge of what the prospect has been accustomed to, forms a good basis in influencing him to make a change. One instance of this came to the writer's attention some time ago. A certain large

tire manufacturer made some alteration in his compound or cure that worked out very disastrously for a time. During this period the cars originally equipped with this brand (and there were a great many) did not yield anywhere near satisfactory tire mileage records. An enterprising dealer immediately collected a list of all cars in his districts carrying the defective equipment and wrote each owner a well disguised form letter with *original* signature. It did not, of course, mention the competing tire by name but was a bang-up, straight-from-the-shoulder "quality talk" and wound up—"Comparisons are not always reliable—but many a —— (name of car) owner has told us, *recently too,* that our casings have taken the ire out of tires and made motoring a real pleasure. We can do as much for you." His percentage of actual returns was unusually high in this instance due to the timeliness of the appeal.

Selling the Ford Owner

Worth-while tire profits for the dealer are achieved only when backed up by a substantial volume of business. A selling scheme, therefore, which does not completely embrace the every need of the Ford car owner, constitutes a hopeless handicap. The slogan "Watch the Fords go by" has been retranslated to "Stop the Fords as they go by—and sell them something." Many a dealer owes the foundation of his sucess to his knack of horning in with Henry. What sort of a tire deal is the Ford man looking for? You can safely assume that he will be influenced largely by a reasonable first cost—but note that each year brings a larger number who look beyond this initial saving to the permanent economy of a Low-Cost-per-Thousand-Mile. To perfectly harmonize the two essential angles—to meet the Ford owner half-way on mileage is the dealer's problem. So far as the price

buyer is concerned, you have no doubt a very good chance to interest him in your cheaper brand unless the owner is a rank beginner and insists on a "jitney" tire. If he does you will lose him for a time to the price wrecker, with odds that he will return to the fold at a later date dragging his goat behind him. The other portion of the Ford field constitutes as wise a group of motorists as the country contains. They've got it all doped out that good tires cost more than poor tires and are quite prepared to pay more to *get* more. They will be influenced a lot by your cost per thousand mile comparison and if you play the game clean and square with them you will find this part of your business extremely pleasant and profitable. But don't think for a minute that the dealer who gets his share doesn't earn it.

Advertising Angles

Returning to the question of newspaper advertising the dealer would do well to start the campaign with a bang—tell his story big to begin with. The dealer who is just starting on a newspaper career has got to holler a little louder than those veteran advertisers who are travelling with the momentum of previous publicity behind them. A good idea for a full page spread is shown in Fig. 51, but it must not be expected that a dealer can continue to use heavy artillery. He will do better by using less space and using it often, in fact just as often as his budget will permit. Change the copy as frequently as possible and utilize to the fullest extent such electros and "make-ups" as may be supplied by the manufacturer.

Remember always that advertising is a means to an end—but not the end itself. The whole purpose of advertising is to make some one think the way you do about an article—and keep him thinking that way. Just buying space won't do this. The main things to

JOHN M. HAYNES CO.

"At Your Service"

¶ Plenty of the right kind of motoring necessities at your immediate command. Exclusive distributors of

———6000 Mile Tires and Heavy Red Tubes.
———3000 Mile Tires and Grey Tubes.
——— Spark Plugs—"Make every cylinder hit."
——— Gas —"More Power."
——— Oils —"Perfect Lubrication."
——— Products —"Supreme Accessories."

¶ Utilize our service facilities — free air and tire inspection—curb gasoline service — telephone booth — touring information — tire repair department.

¶ We carry nothing in stock that has not already proved its value abundantly, yet our prices are surprisingly moderate.

JOHN M. HAYNES CO.

Fig. 51. A Well Balanced Newspaper Ad

know are *What* to advertise, *When* to advertise and *How* to advertise, and remember that space in a newspaper is nothing but an opportunity to *say something* to your prospect. If your advertising is going to bring in returns, it will be because *First* it is the truth, *Second* it will promise *less,* instead of more, than you can deliver, *Third* it will have an appeal to the reader's interest, and *Fourth* it will be so carried on as to be regular and persistent. An advertisement is little more than a guide post to direct the reader where he can do well for himself. If the dealer's guide posts fail to do this in all honesty, the time will come when no attention will be paid to them. In fact an instance comes to mind where a dealer decided that the claims made through National advertising by the maker of one of his cheaper tires were more than the merchandise could live up to. In order to prove his personal integrity he took pains to temper these claims in every possible way. He realized that the tire while a good value at the price he asked was not of superlative excellence. His frankness in the matter actually made friends for him and by making the sale on a fair basis he avoided the complaints of hundreds of his customers who received something less than they might have originally expected.

"Something for nothing" no longer appeals to an intelligent public—but the real tap root of satisfaction is to always render the customer a little more than he *expected,* to give more than you promise—never *less.*

Service—How to Give It

Service like charity covers a multitude of sins. It is often the vital factor which separates the successful dealer from the failure. Service must not be considered as the giving of something for nothing—in the best sense of the word it affords the dealer an opportunity of *getting* a

whole lot for a very little. It is a means of capitalizing his time and ingenuity. Take the instance of the dealer who by heavy advertising "gets them coming" but who renders his clientele only the bare merchandise in return for their money. When it come to *keeping* them lined up he finds himself bankrupt of resources—unless indeed his merchandise is head and shoulders above local competition. He is almost forced to fall back on that very temporary and unprofitable expedient of extra discount concessions. A little of the right kind of service introduced here might easily change the whole situation. People are creatures of habit—and they form habits along the lines of ease even more readily than they do when economy alone is concerned. If this dealer could find a way to make it easier and quicker for his customers to trade with him, he could no doubt cut down his advertising account considerably and have enough strength in reserve to maintain his regular list prices intact. It is difficult to take service apart and find what it is composed of—but the rational way of approaching the subject is to put yourself in the motorist's place, and start right in making a list of the things that would count heavily with you. Service starts with the stock itself. It implies a sufficient quantity of the right kind of goods so that supply follows demand *instantly*. Right here some provision as to emergency delivery is helpful—*free* if possible or at bare cost to the dealer if not—certainly if delivery is made over the counter the tire should be put on and inflated free of charge. With every tire sold the dealer should include a mileage record booklet containing hints on care of the tire and an inflation table. The sale of an air gauge is also in order if the customer is not already equipped and a tube brought to his attention. Tire repair kits containing

talcum, cement, emergency self-vulcanizing tube patches, inside and outside blowout patches and the like will often commend themselves to the customer's judgment and operate directly to his profit and indirectly to the dealer's profit in rendering his customer's tire problem less annoying. The free air and inspection features are invaluable and the oftener taken advantage of the better for all concerned. Inspections give the dealer a chance to nip abuses in the bud and by prolonging the life of the tire reduce adjustments to a minimum. A dealer will soon notice evidences of improper inflation, wheels out of align, unequal brake tension, and correct them in time. Where large cuts are present the dealer can recommend repair before too late. In this connection if the dealer does not have a repair outfit of his own, he would do well to make arrangements either locally or in a nearby town with some one who makes a specialty of it. There is a fair margin of profit in the work and the repair feature is certainly a big factor in up-to-date tire service. Inspection also gives the dealer an opportunity to know more about competing tires which may be in use and also to estimate in advance the future needs of the customer. This work takes very little time and is teeming with money making opportunities. Another phase of service that is appreciated by customers is honest information regarding probable price advances, and is a form of protection a dealer should be glad to extend whenever possible.

In some parts of the country service has been so overemphasized as to be almost a burlesque on good business methods. In St. Louis for instance it is quite common for a dealer to maintain several service autos equipped with air tanks and stand ready to go to a customer's assistance at any time of night or day in a radius con-

siderably wider than the city limits. Department stores meet this competition by giving a tube free with each tire, or in discounts or premiums. From an impartial standpoint this looks like service gone to seed as it imposes an unfair tax on doing business. It also arouses a temptation to make up this loss either by selling indifferent merchandise at premium prices, or by a manipulation of the manufacturer's mileage warrant. This adjustment feature, which is the cap sheaf of the dealer's service policy, will be discussed in the following chapter.

CHAPTER IX

Adjustments

The great bugaboo of the tire business is the adjusting feature. A successful accessory merchant who for years had resisted a strong temptation to carry tires, said to the writer that the tire business reminded him of Johnny and his cold. His teacher kept jacking him up for not blowing his nose. Finally he blurted out, "I've blowed and blowed but it won't *stay blowed.*" The merchant's contention was that tires also could be sold and sold, but could not be made to *stay* sold.

Great Expectations

This of course is a one sided view, for tires are just merchandise after all and can be merchandised in such a way as to reduce returns to a negligible percentage. There are several contributing causes, but undoubtedly the greatest is the fact that the consumer is unable to tell anything from the *looks* of a tire as to the measure of its strength. Since all tires look so much alike he feels sure that they ought to yield results that are approximately equal. Dealers who make extravagant and unqualified claims for their tires do much to reenforce this ill founded opinion and it is a boomerang for the industry. Then too, the conditions under which a tire delivers its mileage are extremely exacting and of an obscure nature. If you sell a man a fine chisel and he drives it into a nail he realizes that it was not legitimate use, but downright abuse which

did the damage. On the other hand all four tires go into action "under a blanket," and while every condition under which they operate may be more rankly unjust than the instance of the chisel—still these adverse conditions are so hidden as to be apparent only to the experienced observer.

Cause Precedes Effect

It is purely a matter of cause and effect—the chisel abuser sees *both* and is not misled, while the motorist too often sees only effect and makes a guess as to the cause. If he has been led to expect 4000 miles and gets 2000 he is quite apt to believe that the cause originated with the maker, particularly if he is a "safe and sane" driver. The greatest advance that a dealer can make in getting his goods to stay sold is to turn the spotlight on these causes—not after the damage but before. Take the average motorist—ask him if his wheels are in align or his brakes in equal tension and he will be unable to give a positive answer—yet these two conditions plus underinflation account for a great majority of all adjustment claims. A skillful adjuster once told the writer that nine out of every ten tires he passed on were rankly abused—yet in spite of the tendency of some honest men to lie about tires and taxes many of these claims were made in good faith. Contrasting views of tire adjustments are aptly illustrated in Figs. 52 and 53.

Post Mortems

The Post Mortem examination of tires is a very interesting part of the business and calls for the highest degree of analytical qualities linked to a staggering technical knowledge of tire construction. Every factory maintains a separate department for this work in charge of men who do nothing but inspect dead tires to find out what killed them off. Being a first-class tire adjuster calls for more than

The Tire Adjuster Has a Remarkable Brain—*By Goldberg*

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Fig. 52. The Average User's Version of an Adjustment

science—it's a gift—such men are born rather than made. If you were to take one of them apart you would

Fig. 53. The Manufacturer's Idea of It

have an inventory of those qualities which go to make a technical expert, an efficient credit man, a Pinkerton

Detective, a Chief Justice, an Ambassador Plenipotentiary and a Major League Umpire.

Whenever a deceased tire is brought to their attention they must ascertain the crime, if any, that has been committed against it, and who did it. Their first concern is to locate any structural weakness in the tire itself, and while in a tolerably small number of instances the felon can be located right in the factory, the vast majority demonstrate that the careless owner is responsible. The difficult part of the matter is that ignorance rather than willfulness has caused the damage. The very fact that many claims are based on evidence which the owner believes to be nothing but the petrified truth calls into use the highest degree of diplomacy.

It can be positively stated, however, that in the majority of cases, the adjuster, whether in the factory or on the firing line of the dealer's counter, is a conscientious cuss who renders his verdict strictly in accord with the facts as he sees them. More than that, he is trained to give the user every benefit of the doubt.

Wasting $150,000,000

A fair and unbiased word picture of conditions as they actually existed in the year 1916 was given in an April number of the *Los Angeles Examiner* as follows:

"ENORMOUS TIRE WASTE IN 1916

"Last year the motorists of the United States took from their wheels and replaced some nine million tires, which had apparently run their course, representing an original expenditure of about $300,000,000. The cry of the car owners who discarded this great multitude of tires is for *better tires, less tire trouble, fewer tire changes, longer tire life, lower cost per mile.* Yet

through the application of the simplest methods of tire conservation, at the command of every motorist, it is estimated that fully one half of this enormous mortality in tires and loss in money might have been prevented. Thousands of these tires were replaced because they had passed away before their time. If $150,000,000 of the nation's tire bill could be saved annually five magnificent highways could be built across the continent each year and the nation so honeycombed with motor roads as to put every nook and corner of it in direct touch with the big centers of population. Another Panama could be built in three years, the national debt lifted in seven years, or a fleet of ten first-class battleships built for our navy each year." The conservation of even half this waste would be a splendid national economy and along with it would come a general bettering of conditions under which the tire business is carried on. It is surely up to every man connected with the enterprise to do his part in bringing home these facts to the tire user—from a purely selfish standpoint alone it will pay big dividends to both user and dealer.

Putting the Just in Adjustments

Assuming that the jobber or dealer is willing to put his shoulder to the wheel, let us get right down to brass tacks and consider definitely how he can get the best leverage for action. In the first place his mental attitude should be as impartial as a chief justice in considering and equalizing the conflicting opinions of the owner and maker. Above all he must be fair to the tire itself, for he is its sponser, and its performance either vindicates or condemns his judgment. In short the dealer must strive to put the just into each adjustment that comes under his observation. He cannot of course disburse justice until he is equipped with a knowledge of cause

and effect as applied to tire mileage—and it is right here that intensive investigation should be made.

Saving Air and Wasting Dollars

The master accomplice in almost every crime against mileage is underinflation. Air is the cheapest and at the same time the most effective panacea for a majority of the ills that tires are heir to. When the tire manufacturer sells the product he assumes that the figures given in his inflation table will be adhered to. It is not the tire itself that delivers mileage but the compressed air which it holds. The tire is but the container for this greatest of all shock absorbers and it is made strong enough to withstand two or three times the pressure recommended by the maker. A rule of thumb inflation formula is quite generally used by veteran car owners—usually twenty lbs. to every inch of cross section diameter. In this instance a 34 x 4 tire would carry 80 lbs. which corresponds fairly accurately to the average manufacturers' table for fabric tires except that the latter makes allowance for different weights whereas the former is roughly fixed for all weights. There is no real necessity for hair splitting on the subject so far as our problem of conservation is concerned. The main consideration is not how *little* air can be safely used, but how much air a consumer can be coaxed into taking. Many motorists use forethought in this matter but are inclined to reduce the pressure willfully so that the car will ride easier. This is of course an owner's prerogative but it should properly abrogate any claim he might make against the manufacturer for poor mileage. It would be much cheaper to invest in good springs and shock absorbers, and no doubt this will be one of the consummations that an intensive educational campaign will bring forth. Another deliberate side of underin-

flation is represented by the owner who reduces his pressure in hot weather in the belief that the expansion of the air due to heat will cause blowouts. Reasonable as this may seem nothing could be further from the truth —there is expansion of course but so slight as to be ridiculous in connection with blowouts. Read what Mr. C. S. Thompson of the Miller Rubber Co. has written in the *New York Tribune* of September 30: "Hot pavements and the heat of the sun won't increase air pressure in a tire enough to blow it out, any more than the same sun-heated pavements will cause hair to grow on a billiard ball. Every tire heats up when it is in motion on a car, but it isn't the heat of the sun that causes it. Not by a jugful. Any man who knows anything about tire construction will tell you that heat is generated not on the outside but on the inside of the tire. A tire is made up of several layers of canvas fabric. This friction generates heat, which is absorbed and passed on to the air in the tube. I am enclosing herewith two pieces of cotton fabric the same as is used in making tires. Take a piece in each of your hands, then rub the two bits of fabric together briskly for half a minute and see how all fired hot it gets. This same friction is what heats up a tire, and not old John Henry Sun.

"And while this heat increases the air pressure within the tire, it does not increase it nearly so much as is popularly supposed, and not enough to affect the strength or the structure of the tire in the slightest degree. Any tire engineer will tell you that this added pressure from the heat is in direct proportion to its temperature (the volume of air remaining the same) above the absolute zero, which is 459.2 degrees below zero F. For example a 34 x 4 tire, inflated to its proper pressure of 72 lbs. per square inch, with air at 50 degrees F. would have

a pressure of only 82.4 lbs. per square inch at 125 degrees F. One hundred and twenty-five degrees is pretty hot, but the increased pressure is not sufficient to cause a blowout. You can readily appreciate that this increased pressure is not a factor, because any well made tire will withstand several times the amount of pressure recommended for its use.''

When we come later to discuss each aspect of tire abuse in detail it will be noticed that underinflation is a contributory cause in almost every instance of a tire's premature demise. You see its subtle influence in the sudden blow-out, particularly where a stone bruise has been inflicted on the carcass. In this instance some object has been encountered which bends in the tread at this point and violently displaces the fabric. Generally no mark is left on the tread itself but the carcass is so badly fractured as to cause a blowout ultimately. Now if the carcass had been supported by adequate air pressure it would have in most cases withstood the blow without damage. There is lively sale for many kinds of outside tire protectors—canvas, leather, steel studs, etc., but the greatest protector possible is the invisible armor of thorough inflation—and it costs nothing.

From the Tire Morgue Criminologists affirm that every crime leaves its clue—and those misdemeanors against mileage which outlaw the motorist are no exception. It is true that some cases show such a cumulative record of abuse as to make it exceedingly difficult to point out the original cause for each. Proper diagnosis here is just as hard to make as in the case of a medical post mortem—one in which the patient had suffered simultaneously from sciatica, boils and blind staggers. A careful study of the accompanying photographs will however help us to get at the underlying

causes, and reveal certain valuable clues in locating cases of rank abuse. Let us take up a few of the most typical instances of tire misuse.

Under-inflation

Here is a tire (Fig. 55) that has been strangled to death—the owner has carelessly cut off its air supply. It has been run with so little air that the side walls bulge out instead of rising to the tread in an easy curve. This angle along the sidewalls makes for extraordinary stress at that point, accompanied by a constant bending of the fabric. Take a wire in your hand and this bending at a given point will soon break it—and the effect on the fabric plies is exactly similar. Another sinister side of underinflating a tire is its consequent loss in unity—instead of being substantially supported by an air cushion which will hold each part rigidly in place, it is subjected to the bending and warping incident to road contact. Rim cutting, tread separation and stone bruises are actually invited by such a condition. Underinflation in fact constitutes a sort of general debility and a tire so affected, like a man with a "run down" system, is subject to almost any sort of trouble.

Stone Bruise

While underinflation is a deep and underlying *cause* "stone bruise" is really an *effect*. An adjustment due to "stone bruise" is one of the most difficult to make due to the fact that the consumer is almost sure to take the position that the tire is wholly at fault. Underinflation has paved the way for the majority of "stone bruise," the nature of which is described in one of the Goodrich bulletins. "On the inside of the tire shown in the cut you will notice a large break in the fabric. This resulted from an accident, the wheel passing over a stone about the size of two fists. This caused the injury

shown in Fig. 54 without leaving the slightest mark on the outside of the tire. We have found it difficult in some instances to convince our customers that a tire showing this condition is not defective, when in reality

Fig. 54. Stone Bruise

it is not a fault nor indication of weakness, as any tire will act in the same manner. In a tire subjected to this abnormal strain, the fabric is bound to give way, but it does not necessarily follow that the outer cover will be

Fig. 55. Under Inflation

Fig. 56. Faulty Wheel Alignment

Fig. 57. Neglected Cuts

marred, especially if the object is smooth and blunt.

"To better explain our point, we would say if a tire

under pressure should receive a hard blow from a sledge hammer, the fabric would break in this manner without leaving the slightest mark or indentation on the outside of the case. For your own curiosity, take a piece of heavy rubber, and with a hammer see how difficult it is to make an indentation in it. Sometimes a tire may be run weeks after the fabric is broken from the bruises before the blowout occurs. It has even happened in a garage, with the car standing still. Sometimes the break will only exist in a few of the plies of fabric, which will pinch the tube, allowing the tire to deflate gradually."

A "stone bruise" *can* occur when the tire is kept fully inflated but the tendency to carcass fracture is magnified many times by underinflation. This break generally occurs at the edge of the tread or along the side wall and can be seen on the inside of the tire. It will almost invariably start a tear running diagonally across the inside following the grain of the fabric. Where a sharp object has penetrated clean through the tire the cut itself may be at any angle, but the forces of the air rushing through the aperture will generally start a tear at each end of the cut, and these tears will follow the diagonal line of the fabric grain.

Faulty Wheel Alignment

The tire shown in Fig. 56 never had a chance. The wheel on which it was placed was badly out of line, due to bent angle or steering knuckle, poor or broken bearings, or a hard blow received in running over or against an obstacle. You will note the tread is worn off completely and the breaker strip, cushion stock and a majority of the fabric plies have also disappeared. The side-wall and inside of the casing gave every evidence of newness and a careful examination revealed no struc-

tural weakness either in materials, compounding or assembly. This tire simply fought a losing fight and petered out finally at 600 miles which was one-tenth of its warranted mileage. In fact the handicap of a badly running wheel is more than any tire can overcome. It produces a sliding and scraping action from side to side, which sets up a "buffing" process between the tread and the road. The effect is about the same as would be produced by a persistent attack with an emery wheel. The tire in question was returned by the consumer with a request for recompense, but the adjuster very properly took the position that the tire had already produced more mileage than could have been properly expected under the conditions—and refused any adjustment whatsoever. The *Goodrich Bulletin* states, "We know of one instance where after an axle had been slightly bent, resulting from an accident, the two front tires were worn entirely through and the inner tubes blew out in the short space of fifty miles. The wearing of the treads of course will be in proportion to the seriousness of this condition. It is sometimes so slight as to make the wearing off of the tread almost imperceptible."

Luckily the clue to this sort of abuse is extremely apparent. A tire will wear down to the breaker under other conditions, but observe in this case there is a typical *angle* between the side wall and tread which can be immediately detected. In the case of a tire legitimately worn down by long mileage, there will still be a slight curve left in the tread from side to side, whereas under bad alignment the tread will be quite flat, as though it had been stripped by a knife. The illustration indicates the characteristic appearance of tires which have been submitted to this abuse.

Neglected Cuts

Cuts that extend through the rubber so as to reach or penetrate the fabric carcass are the forerunners of serious trouble. Whether large or small they make possible the entrance of sand, pebbles and moisture which quickly deteriorate and ruin the tire. (See Fig. 57.) It is right here that timely inspection and repair will save many dollars' worth of potential mileage—in fact there is no better example of the old adage, "A stitch in time saves nine." A cut taken at its inception is very inexpensive to repair, whereas a blowout generally involves putting in a whole section. Even after this expensive repair the tire has lost a great deal of its compact strength and future trouble is apt to occur at or near the seat of repair. Blowouts due to neglected cuts invariably give the adjuster a great deal of trouble—both in arriving at a correct diagnosis and in convincing the owner that the adjustment has been made fairly. Too often motorists take the stand that any wholesale blowing out is prima facie evidence that the tire was defective. Quite often the jab itself is only an inch or so long and passes unnoticed until the explosive force of air under high pressure rushes through the aperture in the moment of actual blowout. This explosion rends and shatters the body of the tire near the cut in such a way as to often conceal all evidence that there has been one. The average factory adjuster will, however, give the consumer the benefit of any doubt as to the cause and will render an adverse verdict only when there is positive proof of abuse. The consumer should be warned to use more than ordinary care in driving during wet weather. Rubber will sustain cuts very readily when wet—just as a dull knife if moistened will cut rubber better than a sharp knife with a dry edge.

What Brakes Do

Very few motorists take into consideration the partnership existing between brakes and tires. Even under the most

Fig. 58. Ruined by Chains

Fig. 59. Brake Skidding

favorable conditions the tax which "braking down" imposes on tire mileage, is considerable—under unfavorable conditions it is tremendous. The Michelin tire

users' hand book is authority for the statement that a car weighing 5100 lbs. traveling at a velocity of 50 miles per hour is equivalent in momentum to a weight of 5100 lbs. falling from a height of 80 feet. In easing down a car from such a speed the brakes are called upon for the lion's share of the work. With a careful driver at the wheel who will apply them so gently as not to lock the wheels the greater portion of retarding will be absorbed by the friction of the brakes against their drums. But when the wheels are locked the whole burden falls on the tires and it is concentrated on one spot. The tire shown in Fig. 59 is a typical instance of skidding abuse and it is probable that it rendered considerably less than half its mileage before being forced out of commission. One of the characteristic clues to this abuse is the "spotty" way in which the tread has been worn down. Portions of it will be in good condition while here and there other portions have been worn down into the fabric. It is an extremely common occurrence in adjusting and the blame should be placed where it belongs, on the well meaning but careless owner. In this connection very careful drivers are sometimes unwitting accomplices in brake skidding due to unequal brake tension, that is where one brake "takes hold" and the other does not. This of course throws the whole burden on the active brake and vastly magnifies the strain placed on its corresponding tire. Even with the most painstaking care that particular overworked tire is pretty apt to be cut down early in life and the careful driver is mad as a hatter in consequence.

Chain Binding

Anti-skid chains have come to stay—but they undoubtedly take a high toll from the mileage a tire ought to give. Under the best conditions where the chains have been applied so

loosely as to distribute the wear evenly over the tread, the strain is slight. Where they have been put on too tight (Fig. 58) the metal gouges into the rubber and inflicts an irreparable damage to the tread. When the cross links are loose, they are free to "creep," hence do not come into repeated contact with the tread in the same place. Note in the accompanying cut, that the tire pictured has suffered in just this way as evidenced by the fact that the cuts appear at regular intervals. One of the Goodyear Bulletins says, "Metal and rubber are enemies—rubber gives but metal does not, and continuous pressure causes the metal to dig into the tread. Paved streets increase this tendency and chains quickly ruin tires used under such conditions." In this connection some drivers occasionally get their chains worn down flat through contact with the road, leaving the edges very sharp. They then carelessly reverse the chains so that these sharp edges bite into the tread—tearing it apart. Chain abuse always tells its own story—it's a cinch for even the novice to detect.

Rut and Car Track Driving

Bad pavements and cobblestones often force a motorist to seek the car tracks for relief when necessary, and no blame can be attached to the driver, but necessary or not, the manufacturer has a clear alibi. Tires are not made to run in ruts or car tracks, and it would be difficult to make one that would, due to the fact that the side wall cannot be made as heavy and inflexible as the tread. The resulting damage is clearly illustrated in Fig. 60. They serve a different purpose and must be just as flexible as possible, which means that no great amount of reenforcing material can properly be placed at this point. In rut running the side walls and a portion of the tread are soon worn down into the canvas,

resulting in a consequent blowout. In car track driving a very apparent groove forms in the side of the tread and the underlying carcass receives a strain of great in-

Fig. 60. Rut Worn

tensity. It is like burning the candle at both ends—with obviously poor results. The driver who feels it necessary to continue to haunt the tracks can at least

mitigate the effect somewhat by frequently reversing the tire so as to distribute the burden more evenly.

Rim Cutting and Bead Trouble

Rim cutting along the side wall just above the bead is generally due to underinflation. Lacking proper support the side walls bulge out and settle down on the rim. This sets up a constant chafing together with a certain bending and flexing at that point which finally causes a fracture. Other instances taken from Good-

Fig. 61. Broken Bead

rich Bulletins are shown in Figs. 61 and 62. In Figure 61 the casing is badly broken just above the bead. The Bulletin says: "This condition was occasioned by the flap being misplaced, due to improperly applying the tire. It is an injury that will result every time under like circumstances. The flap instead of resting between the casing, extended out between the rim and the bead. This caused the latter to seat improperly, producing an abnormal strain, with the result that the casing was broken just above the bead with every appearance of an

ordinary rim cut. Close observation will show that the break registers exactly with that part of the flap which was misplaced. There will also be noticed an impression in the bead where it rested on the flap."

Fig. 62 shows a fracture due to using a straight side

Fig. 62. Straightside Tire on Clincher Rim

Fig. 63. Bent Rim

casing on a clincher rim. The Bulletin says—"There being no lip on the bead of a straightside casing, it naturally follows that there is only one narrow line of contact between the clinch on the rim and the side of the bead. It should be easy to imagine how from the

narrow support, the rim would cut or gouge into the side of the casing. Aside from this, the abnormal strain will frequently cause the bead core to loosen, and place the casing absolutely beyond repair. There is little excuse for a tire user to make a mistake of this kind, there being such a radical difference in the construction of the Clincher and Straightside type of casings."

Fig. 63 shows a condition which is quite rare and confusing even to an expert. The Goodrich expert diagnoses the cause as follows: "While it is generally confusing even to those who have had experience with it, a careful study will make plain the reasons therefor.

"This casing was used on a Q D Rim. The flange or ring on a Q D rim when perfect, will exactly register with the clinch of the casing. Sometimes as in this instance, the flange becomes *warped or bent upwards.* As a result the bead and flange did not register the extent of difference, being governed by the degree to which the flange was bent. The tire seated correctly for the most part, but the non-stretchable bead did not permit its following and seating in the flange the entire way around. Where it did not seat properly, the edge of the flange cut deep in the side of the tire and eventually put it out of commission. Tire users should watch for this condition. It is easily discernible and when detected a new flange should be substituted at once."

Instances could be multiplied by the thousands showing the careless way of an owner with a tire—some with the best of intentions and others in a sort of wasteful thoughtlessness. The individual and national waste is bad enough, but the worst of it is that in a measure at least the just suffer with the unjust. Whenever a manufacturer is forced to make a rebate to the owner

it must be added to the cost of doing business and this cost is made a part of his price schedules. It is devoutly hoped that the coming generation of tire dealers will view adjustments from a broader standpoint—put it on a constructive rather than a destructive basis. It is the least an enlightened dealer can do toward putting the business on a higher and more dignified plane.

On Guarantees

Here is a typical guarantee. "We insure all pneumatic automobile tires bearing our name and serial number to be free from imperfections in material and workmanship. Tires returned for consideration under this guarantee will be accepted only when all transportation charges are pre-

Fig. 64. Stamps Borne by Approved Rims

paid. If upon examination it is our judgment that tires are defective they will be replaced on a basis of 3500 miles or will be repaired at our option. When tires are replaced by us charges will be made to the owners, at the time new tires are delivered, for such amounts as in our judgment will compensate for the services rendered by such replaced tires.

"Tires which have been worn out in unusual service, which have been abused or misused knowingly or unknowingly or applied to rims not bearing stamp No. 1, (see Fig. 64) or on transversely cut rims not bearing stamp No. 2, or on wire wheels not bearing stamp No. 3 are not subject to adjustment. No adjustment will be made when the customer has used in them any substitute for air, or in circumstances where the tires have been subjected to overloading above the weight we

specify, for the respective sides, or in cases where the tires have not been kept inflated up to the pressure recommended by us."

These, dear reader, are the terms under which the average tire is sold to the customer. A Philadelphia lawyer could hardly hope to make the conditions less binding on the maker, yet, if in practice the manufacturer was one-tenth as stringent and inflexible as his written guarantee, he would expect to be sued in the courts. Note the absence of any definite guarantee of actual mileage—it is always stated "on a basis of so many miles" when mentioned at all. Note also that the manufacturer reserves to himself the right of final judgment, and that he nullifies any and all adjustment where *in his opinion* the tire has suffered any one of many abuses and a host of implied abuses. Tough as this may seem, it is not in the same class with the man who is applying for reimbursement. He can get about as stiff-necked and redheaded in trying to slip one over as any one of us might in trying to get the best of a railroad. The dealer must do what he can, from a neutral standpoint, to see justice done.

How the Adjuster Works

Mr. Charles Goss in the August 10th, 1917, issue of *Rubber Age* writes very interestingly on the adjuster's work. "A man brings in a tire for adjustment. After hearing the mileage claim and other information, the adjuster carefully examines the casing: then gives his price for a new tire. It is usually received with a storm of indignation. The adjuster has to 'weather' this and proceed to explain his 'whys' and 'wherefores.' He must be able to convince the customer that his decision is justified by facts. Various methods are used in adjusting tires. Some concerns adjust on the list

price, some do not. When a tire is adjusted on the list price it means that the tire is adjusted on the price at which it was listed to be sold, regardless of discounts and the price at which it was actually sold. An example to make the matter clear: A tire is listed at $50 and sold at less with a guarantee of 5000 miles. The tire is brought in for adjustment after running 1000 miles. The adjuster, if the mileage claim is in accordance with his estimate of the mileage given by the tire, will offer the customer a new tire for $10 which is one-fifth of the list price and not of the price paid for it. As is well known, a tire is hardly ever sold at list price. Some consumers, however, usually demand that the adjustments be made on the selling price. If the customer's business warrants it, the tire manufacturer will adjust on the selling price: which means that if a tire is listed at $50 and sells for $40 and is adjusted for 1000 miles the customer will get a new tire for $8.

"Another method of adjusting is for the adjuster to take the tire and give it a casual examination, disregard mileage claim and guarantee and offer the consumer a tire for a certain amount. Of these three methods of adjustment the best is, probably, the one where the adjustments are made on the selling price, because of its fairness. A tire when brought in for adjustment is usually given a very rigid examination. Its tread and side walls are examined for cuts. The owner is asked numerous questions as to how the cuts were made. The answer bears on the final decision of the adjuster. The same is true with the mileage claim. The final examination is at the spot at which the customer claims the tire to be defective, or where the blowout occurred. The adjuster then sums up and finally adjusts the tire, if in his opinion the claim is justified, on the customer's

mileage claim. If not, he asks a higher price for the new tire, or refuses an adjustment."

Some factories which insist that adjustments be based on the consumers' list price—(assuming that if the tires were not sold at that price they *ought to have been*) temper their policy by conceding the dealer a discount, or profit, on the new tire given to replace the old. In the instance mentioned above the tire which is to be given to the customer for $10 would be billed to the dealer at that price less 10 or 15 per cent. as a recompense for his trouble. In this connection certain unscrupulous dealers have helped to bring adjusting into disrepute by flim-flamming their customers out of a portion of the adjustment made by the manufacturer. For instance, on the case just mentioned the dealer, after receiving the replacement tire at $10 (or one-fifth of its cost) advises the owner that the factory refused to adjust on 1000 miles as claimed but had conceded it on a 2000 mile basis. He then offers the customer a new tire for $20 less 5 per cent. cash and retains $10 plus his own discount. This is a short-sighted policy and whether legally dishonest or not, it violates every principle of square dealing. Honesty ceased to be merely the best policy many years ago—it is now the only policy.

The tire industry is full of the snap and go peculiar to American business in general and is barely out of its infancy. What the future growth of this vast enterprise will bring to us, lies beyond the wildest dreams of avarice, but the dealer himself will be one of the determining factors. He is the medium of communication between Maker and User and unless he squares his marketing methods with business principles of proven merit, he will be like a half finished bridge, leading nowhere.

Business transactions are never neutral. Each opera-

tion works for or against the dealer—with each act his prestige and good will are either enhanced or jeopardized. The final balance represents an asset or a liability which is shared by the entire industry.

CHAPTER X

"Tire Lingo"—A Dealer's Dictionary

Adjustment. A method of reimbursing the user for the difference between the mileage actually obtained and the mileage he should have received. Adjustments are in order *only* when there is a defect in material or workmanship.

Alignment. An adjustment of the wheels that will ensure their running parallel to each other. When out of align the wheels quickly buff off the tread. Front wheels are usually "toed in" slightly as an aid to steering, but must be watched constantly since any angle beyond normal will cause the tires to run on the sides.

Bead. That part of the tire which is in contact with the rim and which holds it firmly to the wheel.

Breaker. A heavy and loosely woven fabric lying just under the "crown" of the tread. It takes up the shock of road buffeting and distributes the strain evenly, thus protecting the carcass.

Blowout. A violent rupture of the tire fabric, generally of an explosive nature. Blowouts are due to a variety of causes. They should be thoroughly repaired and vulcanized before the tire is put into further use.

Bolted on Tire. An out of date method of fastening the tire to a specially constructed rim by means of locking rings fitted over the bead and retained by bolts.

Balance. (a) The technical harmony of each part of a tire to the whole—a vital factor in tire value.

(b) A merchandising harmony between Price and Performance—between what a tire *costs* and what it *does*.

Balanced Stock. An inventory showing a harmony between supply and demand as to price, type and size.

Bailey Tread. One of the first practical non-skid types invented by Mr. Bailey and depending on small rubber studs in the tread for its anti-skid value. Formerly in general use by many companies who manufacture it on a royalty basis but now largely displaced by individual designs.

Blister. (a) Formed by air or moisture getting into the tire before vulcanization. The expansion due to the high temperature attained in that process forms the lump or blister.

(b) Sand penetrating through a cut so as to gather between tread and carcass.

(c) Oil or volatile distillates setting up a chemical change in the rubber and causing a puffing or blistering.

(d) Separation of tread from carcass due to underinflation or defective making.

Casing. The tire itself—exclusive of tube. See also Shoe.

Core. An iron form in the shape of a wheel over which a tire is assembled.

Cushion. Or "Cushion stock" Rubber of the highest grade acting as a shock absorber and binder between carcass and tread. Must have great resiliency and tensile strength to be effective.

Clincher. A tire with a stretchy bead, so shaped as to form "cams" or nubs which fit under a clincher rim.

Ceylon. Plantation rubber grown in the Island of Ceylon generally extracted from the transplanted Hevea tree native to Brazil.

Compound. Rubber which has received its quota of tempering drugs and chemicals.

Cure. The process by which rubber is tempered and vulcanized. It involves a compound subjected to heat at a certain pressure and accomplishes a profound change.

Calendering. The process by which rubber is rolled out into sheets or through which rubber is forced into fabric. The calender machines consist of heavy steam rolls which can be adjusted to minute fractions of an inch.

Carcass. The fabric foundation on which the rubber tread and sidewall is placed.

Combination Cure. Same as Double Cure.

Cord Tires. A tire whose carcass is composed of cords running at different angles and set in insulations of rubber.

Consignment. A marketing arrangement in which the merchant does not own his stock, but acts merely as an agent. Inventories are rendered the owner at stipulated intervals accompanied by remittance covering tires sold, less commission. A clumsy, expensive, and out of date device whose only excuse is the protection it affords the owner against fraudulent loss and the opening it gives dealers to do business on a small investment.

Double Cure. A process by which the carcass and a superficial rubber cover are assembled together and partially cured, the tread band being applied later and the whole tire finally vulcanized.

Drying. The process of removing every atom of mois-

ture from the parts of a tire so that vulcanization will not bring about blisters.

Fabric. Cotton duck of long staple and great tensile strength used in forming the plies which make up the carcass.

Friction. Cotton duck which has been impregnated with rubber by calendering, thus making it waterproof and affording adhesion between the plies.

Gum. Technical name for raw rubber.

Guarantees. The maker's pledge as to the integrity of his product in terms of mileage it should yield under normal conditions. It covers only defects in material and workmanship and it is not an unqualified guarantee of definite mileage yield.

Inflation Table. A chart showing the number of pounds of compressed air recommended by the maker in using his tires. The table fluctuates in proportion to the cubic air capacity of the tire and the load it must carry. Most manufacturers cancel their guarantee where underinflation is evident.

Lugs. (Also Stay Bolts) Bolts extending thru the rim and having a spreader which when tightened from the outside, forces the tire beads against the rim. Not in general use today for pleasure vehicles.

Latex. The sap of the rubber tree before being coagulated.

Lamination. An assembly of several sheets of rubber into a single unit, often used in tread and tube assembly.

Mold. A metal form in which the tire is encased when vulcanized by the mold process.

Non-skid. A design which calls for projections or depressions in the tread and which tend to grip the road firmly.

One Cure. See Unit Cure.

Overloading. The use of a tire equipment of inadequate air capacity in relation to the burden to be carried.

Oversize Tires. The remedy for overloading. An oversize tire has a cross section diameter ½-inch larger than standard and a tread to tread diameter 1 inch greater. Thus the oversize 30 x 3½ is 31 x 4.

Para. Rubber from the Amazon regions of Brazil. It is extracted from the Hevea tree growing wild in a vast area of valley wilderness. The name is derived from the exporting port of Para at the mouth of the Amazon.

Pinched Tube. When a tube is caught under the beads during inflation it is so pinched as to cause a puncture. Pinching generally leaves a characteristic mark on the tube which can be readily detected.

Pneumatic Tire. A tire depending on compressed air for the major portion of its resiliency. Practically all pleasure cars use them exclusively, and there is a tendency for commercial cars to discard solids for pneumatics.

Quick Detachable Clincher or Q D. A tire similar in appearance to the Clincher, but having an inextensible bead. It is put on by removing a side ring from the rim.

Quick Detachable straight side or "Straight Side." All straight side tires are Quick Detachable as the beads will not stretch—hence they must be applied in the same manner as a Q D Clincher or by reducing the rim diameter by bending it on itself.

Quantity Schedules. A marketing device whereby the retail buyer of large quantities receives a preferential price or discount. A sinister factor that has but few plausible arguments to defend it.

Rims. A metal binder around the circumference of the wheel to which the tire is attached. For different types see Clincher, Q D Clincher, Straight Side and Universal.

Rim Cutting. Damage inflicted to the side of a tire by defective broken or bent rims or by underinflation which allows the side wall to chafe against the rim.

Rubber. A tough and elastic substance which is extracted from certain trees, vines and shrubs, found in tropical regions. There are many grades of rubber but a general classification divides rubber into either transplanted plantation gum or (native) wild rubber.

Straight Side. See Q D Straight side.

Stay Bolts. See Lugs.

Semi Cure. See Double Cure.

Solid Tires. Composed of solid or semi solid sections of compounded rubber. Applied by bolts or by pressing on to the rim and rarely used on pleasure cars.

Skim Coat. A fine coating of rubber often applied to friction so as to increase its insulating and adhesive values.

Stone Bruise. The term given to a carcass break occasioned by a blow received from a stone or some other obstruction. The true stone bruise inflicts no visible damage to the tread so that a blowout is the first indication. Proper inflation is a great bulwark against stone bruising.

Soap Stone, or Talcum. Heat develops to a high degree in the inside of a tire while running above normal speed. Soap stone or talcum affords a lubrication which reduces this to a minimum and preserves the tube.

Tensile Strength. A measure of the power to resist

stress expressed in lbs. Both duck and rubber compounds are often tested to breaking point so as to establish the amount of toughness.

Tire Types. See Clincher, Q D and Straight side, Pneumatic and Solid, Non-skid and Plain tread, Fabric and Cord.

Unit Cure. (a) Unit Molded, a method by which a tire is assembled, placed in molds and completely cured at one heating or vulcanizing. (b) Unit Wrapped —Similar to the above except that the tire is not placed in a mold but wrapped with damp cloth and cured at one heating.

Underinflation. The cause of a majority of instances where a tire gives unsatisfactory mileage. Tires should be kept at or above the pressure recommended by the maker.

Universal Rim. A rim so designed as to accommodate itself to Clincher, Q D or Straight side tires by a change in the position of the side rings.

Valves. The channel thru which air is introduced into the tube. A valve is comprised of stem, lock ring, washer, hexagonal nuts, stay-bolt head or clip, valve cap and dust cap.

Vulcanization. The heating process by which a vast chemical change is accomplished in the compound. Vulcanization transforms it from an inert dough to a tough and resilient material of highest commercial values.

Wrapped Tread. See Unit Cure (b).

Washing. The method by which impurities are extracted from crude rubber. The gum suffers a high percentage of shrinkage in this process.

CHAPTER XI

Valuable Tables and Statistics

Statistics and How to Use Them

Statistics are generally dry and uninteresting at best, but the intelligent use of them is of immense value to any business man. Sir Eric Geddes, that dynamic American trained Lord of the Admiralty and head of the British business organization for carrying on the war, was asked what single rule had been of the most service to him. Quick as a flash he snapped out "The use of statistics—I statistize everything. Knowledge is power and statistics are the throttle valve of every business. But don't let statistics master you—use them." At eighteen Geddes was a section hand on the B. & O. R. R. in West Virginia, at twenty-seven he was the dominating head of the railways of India and at forty-two he is one of the overlords of England. Statistics make available the condensed experience and information of previous years and carry with them a first class peek into the future. The man who knows what has happened in the past and has noted the changing tendencies of each year, can come very close to knowing what is ahead—consequently he has time to prepare for the future before vast changes are thrust upon him.

Statistics and tables, taken by themselves, are of no value except as yardsticks with which to measure the present and future,—the past of course interests no one for its own sake. The tire business at best is a dependent enterprise—a little brother of the automobile in-

dustry. Its vital statistics are primarily bound up with the factors which control the growth and distribution of motor vehicles. It is evident then, that the very foundation of all estimates concerning the tire business lie in the annual rate of motor car production. (See graph on page 6.) This table establishes the bulk demand for tires—roughly estimated to be five tires per annum for each car. But this information is too general—it is a sort of raw material that must be considerably refined before it can be of practical use. The next step is to determine the distribution of this bulk demand expressed in the sizes and types of tires which will be required. The general percentages for 1916 showing the ratio of clincher, Q D Clincher and straight side types to the total tire production are given in Table III while the itemized figures are given in Tables I and II of this Chapter. These tables bring the vital statistics home to the dealer in the most available form and show at a glance the merchandising value of the individual tire.

TABLE I

Tire Equipment

Specifications Used on Principal Makes of Pleasure Cars in 1915-16-17 and 18

Abbreviations: "F" Front, "R" Rear, "C" Clincher, "QDC" Quick Detachable Clincher, "QDR" Quick Detachable Reversible, "SS" Straight Side.

CAR	MODEL	TIRE SIZE		TYPE
Abbott				
1915	K and H	F&R	34x4	SS
	F	" "	35x4½	SS
	L	" "	36x4½	SS
1916	8-80	" "	35x4½	SS

CAR	MODEL	TIRE SIZE		TYPE
Abbott (Continued)				
1916	6-44 Coach & Sedan	F&R	33x4½	SS
	All other models	" "	32x4	SS
1917	Sedan	" "	33x4½	SS
	Other models	" "	32x4	SS
1918	6-44	" "	32x4	SS
	6-60	" "	34x4	SS
Allen				
1915-16-17-18	All models	" "	32x3½	SS
Anderson				
1916-17-18	All models	" "	33x4	SS
Apperson				
1915	4-40	" "	34x4	SS
	6-45	" "	34x4	SS
	6-48	" "	34x4	SS
	4-45	" "	36x4	SS
	6-60	" "	36x4	SS
1916	6-16	" "	34x4	SS
	8-16	" "	35x4½	SS
1917-18	6-17 and 18	" "	34x4	SS
	8-17 and 18	" "	35x4½	SS
Arbenz				
1915	All models	" "	36x4	SS
1916-17	25	" "	30x3½	C
Auburn				
1915	4-36	" "	32x4	SS
	6-40	" "	34x4	SS
	6-47	" "	37x4½	SS
1916	4-36	" "	33x4	SS
	6-38	" "	34x4	SS
	6-40 A	" "	35x4½	SS
1917-18	6-39	" "	34x4	SS
	6-39 C	" "	34x4	SS
	6-44	F	34x4	SS
		R	35x4½	SS
Austin				
1915-16-17	All models	F&R	34x4½	QDC
1918	12	" "	34x4½	SS

CAR	MODEL	TIRE SIZE		TYPE
Biddle				
1915-16	C & D	F&R	32x4	QDC
1917	D	" "	32x4	QDC
1917-18	H	F	32x4	QDC
		R	33x4½	QDC
Bour Davis				
1918	18 A	F&R	32x4	SS
	18 B	" "	33x4½	SS
Brewster				
1915-16-17-18	All models	" "	34x4½	SS
Briscoe				
1915	B	" "	30x3½	C
1916	4-24	" "	30x3½	C
	4-38 & 8-38	" "	32x3½	C
1917-18	4-24	" "	30x3½	C
Buick				
1915	C 24 (5)	" "	32x3½	SS
	C 36 (7)	" "	34x4	SS
	C 54 (5)	" "	36x4½	SS
1916	D 44 & 45	" "	34x4	SS
	D 55	" "	36x4½	SS
1917-18	D 44 & 45	" "	34x4	SS
	D 34 & 35	" "	31x4	C
	E 34 & 35	" "	31x4	C
	E 44, 45, 46 & 47	" "	34x4	SS
	E 49 & E50	" "	34x4½	SS
Bush				
1918	18	" "	32x3½	SS
Cadillac				
1915	51	" "	36x4½	QDC
1916-17	53 & 55	" "	36x4½	SS
1918	57	" "	35x5	SS
Campbell				
1918	4	" "	30x3½	C
Case				
1915-16	All models	" "	34x4	SS
1917	T 40	" "	34x4	SS
	U and others	" "	35x4½	SS
1918	U	" "	35x4½	SS

CAR	MODEL	TIRE SIZE		TYPE
Chalmers				
1915-16	26 B	F&R	34x4½	SS
	M 6	" "	36x4½	SS
	32, 32 B	" "	34x4	SS
1917-18	6-30, 5-passenger	" "	32x4	SS
	6-30, 7-passenger	" "	34x4	SS
Chandler				
1915-16-17-18	All models	" "	34x4	SS
Chevrolet				
1915	All models	" "	32x3½	SS
1916	490	" "	30x3½	C
	Other models	" "	32x3½	SS
1917	D	" "	34x4	SS
	490	" "	30x3½	C
	F 2 & F 5	" "	32x3½	SS
1918	FA 2 & FA 5	" "	33x4	SS
	490	" "	30x3½	C
Cole				
1915	6-66	" "	37x5	QDC
	Other models	" "	35x4½	SS
1916-17-18	All models	" "	35x4½	SS
Commonwealth				
1918	All models	" "	32x3½	SS
Crawford				
1915-16-17	All models	" "	34x4	QDC
1918	18-6-40	" "	32x4	SS
Crow-Elkhart				
1915	E 42	" "	33x4	QDC
	E 52	" "	34x4	QDC
	E 62	" "	36x4	QDC
	CE Jr	" "	30x3½	C
1916	CE 30	" "	32x3½	SS
	CE 33	" "	31x4	C
1917	CE 35	" "	32x3½	SS
	CE 33	" "	31x4	C
1918	CE 35	" "	32x3½	SS
Cunningham				
1915-16-17	All models	" "	37x5	QDC
1918	All models	" "	35x5	QDC

CAR	MODEL	TIRE SIZE		TYPE
Daniels				
1915-16-17	All models	F&R	34x4½	QDC
1918	All models	" "	34x4½	SS
Davis				
1915	38 A, 6 C, F, G	" "	34x4	SS
	6 D	" "	37x4½	SS
1916	6 E	" "	34x4½	SS
	H, 6 H, 6 I, 6 K	" "	34x4	SS
1917	6 H & 6 I, 6 K	" "	34x4	SS
	6 J & 6 JI	" "	34x4½	SS
1918	H	" "	34x4	SS
Detroit (Elect.)				
1915-16	All models	" "	34x4½	QDC
1917-18	62 to 66	" "	34x4½	QDC
	68-69	" "	33x4½	SS
Detroiter				
1915	C 5	" "	32x3½	SS
Dispatch				
1915-16-17-18	All models	" "	36x3½	QDC
Dixie Flyer				
1916-17-18	All models	" "	32x3½	SS
	D	" "	33x4	SS
1916-17-18	All models	" "	33x4	SS
Dodge Bros.				
1915-16-17-18	All open cars	" "	32x3½	SS
1917-18	Closed cars	" "	33x4	SS
Dorris				
1915	1 A 4	" "	36x4½	QDC
1915	1 A 6	" "	36x4½	SS
1916-17-18	All models	" "	36x4½	SS
Dort				
1915	4	" "	30x3	C
	5	" "	30x3½	C
1916	4	" "	30x3	C
	5 & 5 A	" "	30x3½	C
1917-18	All models	" "	30x3½	C

CAR	MODEL	TIRE	SIZE	TYPE
Economy				
1916	G 4-36	F&R	32x3½	SS
	C 8-48	" "	33x4	SS
1917-18	G 4-36	" "	32x3½	SS
	C 8-48	" "	32x4	SS
Elcar				
1915-16-17-18	All models	" "	32x3½	SS
Elgin				
1916	All models	" "	32x3½	SS
1917-18	All models	" "	33x4	SS
Empire				
1915	All models	" "	32x3½	SS
1916	45	" "	33x4	SS
	60-70	" "	34x4	SS
1917-18	50-51	" "	33x4	SS
	70 A & 71	" "	34x4	SS
Erie				
1916-17	All models	" "	33x4	QDC
1918	33	" "	33x4	SS
F. I. A. T.				
1915-16-17	All models	F	36x4½	QDC
		R	37x5	QDC
1918	All models	F&R	35x5	QDC
F R P				
1915	B	F	36x4	QDC
		R	36x5	QDC
	A	F	32x4	QDC
		R	33x4½	QDC
1916-17	B	F	36x4½	QDC
		R	36x5	QDC
	A	F	32x4	QDC
		R	33x4½	QDC
1918	B	F	36x4½	QDC
		R	36x5	QDC
Franklin				
1915-16	All models	F&R	34x4½	SS
1917-18	Open cars	" "	32x4	SS
	Closed	" "	33x4½	SS

CAR	MODEL	TIRE	SIZE	TYPE
Ford				
1915-16-17-18	All models	F	30x3	C
		R	30x3½	C
Ghent				
1918	6-60	F&R	34x4	SS
Glide				
1915	30	" "	32x4	SS
1916-17-18	All models	" "	34x4	SS
Grant				
1915-16-17-18	All models	" "	32x3½	SS
H. A. L.				
1917-18	All models	" "	34x4½	SS
Halladay				
1915-16	All models	" "	34x4	SS
1917	RAC 66	" "	35x4½	SS
1918	RAC, 64 & other models	" "	34x4	SS
Harroun				
1917-18	All models	" "	30x3½	C
Harvard				
1917-18	4-2 T	" "	28x3	C
Hatfield				
1918	A	" "	32x4	SS
Haynes				
1915	30 & 32	" "	34x4	SS
	33	" "	35x4½	SS
	31	" "	36x4½	SS
1916	34	" "	34x4	SS
	35	" "	35x4½	SS
1917-18	36	" "	34x4	SS
	37	" "	35x4½	SS
	40 & 41	" "	34x4½	SS
Hollier				
1916-17-18	186 and 196	" "	32x3½	SS
	178	" "	34x4	SS

CAR	MODEL	TIRE SIZE		TYPE
Hudson				
1915	6-40	F&R	34x4	SS
	6-54	" "	36x4½	SS
1916	6-40	" "	34x4	SS
1917-18	Super Six	" "	35x4½	SS
	Speedster	" "	32x4½	SS
Hupmobile				
1915	H	" "	33x4	SS
	K	" "	34x4	SS
1916	5	" "	34x4	SS
	7	" "	35x4½	SS
1917	N & N 4	" "	34x4	SS
	NQ & NU	" "	35x4½	SS
1918	R	" "	32x4	SS
Inter-State				
1915-16-17	All models	" "	33x4	SS
1918	T	" "	32x4	SS
Jackson				
1915	46	" "	34x4	SS
	48-6	" "	34x4½	SS
1916	34 & 348	" "	32x4	SS
	349	" "	34x4	SS
	68	" "	34x4½	QDC
1917	349	" "	34x4	SS
	350	" "	32x4	SS
1918	Same as 1917	" "	34x4	SS
Jeffrey				
1915	4-93-2 & Chestf'l'd	" "	34x4	SS
	6-106	" "	34x4½	SS
1916	4-462	" "	34x4	SS
	6-661	" "	35x4½	SS
1917	All models	" "	34x4	SS
Jones				
1915-16-17-18	All models	" "	34x4	SS
Jordan				
1917-18	All models	" "	35x4½	SS

CAR	MODEL	TIRE SIZE		TYPE
King				
1915	B	F&R	33x4	SS
1915-16	D and E	" "	34x4	SS
1917-18	All models	" "	34x4	SS
Kissel				
1915	4-36 & 6-42	" "	34x4	SS
	6-48	" "	36x4½	SS
	6-60	" "	37x5	SS
1916	4-32	" "	33x4	SS
	6-42	" "	34x4	SS
1917	6-42-5	" "	34x4	SS
	6-42-7	" "	35x4½	SS
	6-38	" "	32x4	SS
	Double Six	" "	34x4½	SS
1918	100 Pt	" "	34x4	SS
Kline				
1915	6-42	" "	34x4	SS
	6-42 a	" "	35x4½	SS
1916-17-18	All models	" "	34x4	SS
Lexington				
1915	6 M	" "	36x4½	SS
	4, 6 L & 6 N	" "	34x4	SS
1916	6 O	" "	32x4	SS
	6 N	" "	34x4	SS
1917	O	" "	32x4	SS
	P	" "	36x4½	SS
1918	R	" "	34x4	SS
Liberty				
1916-17-18	All models	" "	32x4	SS
Locomobile				
1915	M 5 & R 4	F	36x4½	QDC
		R	37x5	QDC
	Roadster	F&R	36x4½	QDC
1916	M 648	" "	37x5	QDC
	R 638	F	36x4½	QDC
		R	37x5	QDC
	Roadster	F&R	36x4½	QDC

CAR	MODEL	TIRE SIZE		TYPE
Locomobile (Continued)				
1917-18	R 7-38	F	36x4½	QDC
		R	37x5	QDC
	M 7-48	F&R	37x5	QDC
	R 7	" "	35x5	QDC
Lozier				
1916-17-18	All models	" "	36x4½	SS
Lyons-Knight				
1915-16-17	All models	" "	37x5	QDC
McFarlan				
1915	All models	" "	36x4½	QDC
1916-17-18	All models	" "	35x5	QDC
Madison				
1915-16-17-18	All models	" "	34x4	SS
Marion-Handley				
1915	All models	" "	34x4	SS
1916	6-40	" "	32x4	SS
	6-60	" "	33x4½	SS
1917-18	6-40	" "	32x4	SS
	6-60	" "	35x4½	SS
Marmon				
1915	41	" "	36x4½	QDC
	48	F	36x4½	QDC
		R	37x5	QDC
1916	34	F&R	34x4½	QDC
	41	" "	36x4½	QDC
1917	34 Touring	" "	34x4½	QDC
	34 Closed	" "	33x5	QDC
	34 Coupe	" "	32x4½	QDC
1918	34	" "	32x4½	QDC
Maxwell				
1915-16	All models	" "	30x3½	C
1917-18	Town car 25	" "	31x4	C
	All other models	" "	30x3½	C
Mercer				
1915	Raceabout	" "	32x4	QDC
	Sportabout	" "	34x4½	QDC
	Runabout	" "	32x4	QDC

CAR	MODEL	TIRE	SIZE	TYPE
Mercer (Continued)				
1916	Limousine	F	34x4½	QDC
		R	35x5	QDC
	All other models same as 1915			
1917	All models same as 1916			
1918	22-73 Limousine	F	34x4½	QDC
		R	35x5	QDC
Metz				
1915	22	F&R	30x3	C
	25	" "	32x3½	C
1916-17-18	All models	" "	32x3½	C
Mitchell				
1915	B 2-35 & B 5-35	" "	34x4	SS
	5 P 6	" "	36x4½	SS
	Other models	" "	36x4	SS
1916	D 2-40 & 5-40	" "	32x4	SS
	Other models	" "	34x4	SS
1917-18	D	" "	32x4	SS
	C 42, Big Six	" "	34x4	SS
Moline-Knight				
1915-16	40	" "	34x4	SS
	50	" "	36x4½	SS
1917-18	40	" "	34x4	SS
	MK 50 G	" "	35x4½	SS
Monitor				
1916	C 4 & R 4	" "	32x3½	SS
	M 6	" "	33x4	SS
1917-18	O 6	" "	33x4	SS
Others same as 1916				
Monroe				
1915-16	All models	" "	30x3	C
1917-18	M, M 4 & M 5	" "	32x4	SS
Moon				
1915	6-50	" "	35x4½	SS
	4-38 & 6-40	" "	34x4	SS
1916	6-40	" "	34x4	SS
	6-30	" "	33x4	SS
1917	6-43	" "	34x4	SS
	6-66	" "	35x4½	SS

CAR	MODEL	TIRE SIZE		TYPE
Moon (Continued)				
1918	6-36	F&R	32x3½	SS
	6-45	" "	34x4	SS
	6-66	" "	35x4½	SS
Moore				
1918	All models	" "	30x3½	C
Murray				
1917-18	All models	" "	34x4½	QDR
Nash				
1918	All models	" "	34x4	SS
National				
1915	A-B	" "	36x4½	QDR
1916	Highway 6	" "	34x4½	QDR
1916	Highway 12 Newport	" "	36x4½	QDR
1917	All models	" "	34x4½	QDR
1918	All models	" "	34x4½	QDR
Nelson				
1918	All models	" "	32x4	SS
Oakland				
1915	37	" "	33x4	SS
	49	" "	35x4½	SS
	Speedster	" "	33x4	SS
1916	38	" "	33x4	SS
	50	" "	34x4½	SS
	32	" "	32x3½	SS
1917	50	" "	34x4½	SS
	34	" "	32x4	SS
1918	34 B	" "	34x4	SS
Ohio (Elect.)				
1916-17	12	" "	34x4	QDC
1916-17-18	42, 43; 62-63	" "	34x4½	QDC
Oldsmobile				
1915	42	" "	33x4	SS
	55	" "	36x5	SS
1916	All models (44)	" "	33x4	SS
1917	37-5 Pass	" "	32x4	SS
	45-7	" "	34x4	SS

CAR	MODEL	TIRE SIZE		TYPE
Oldsmobile	(continued)			
	45-5	F&R	33x4	SS
1918	37	" "	32x4	SS
	45	" "	34x4	SS
Olympian				
1918	All models	" "	32x3½	SS
Overland				
1915	81 T, 81R	" "	33x4	SS
	80 T, 80 R	" "	34x4	SS
	80 C, 82 T	" "	35x4½	SS
1916	75 T, 75 R	" "	31x4	C
	83 BT, 83 T, 83 R, 83 BR	" "	33x4	SS
	86 T	" "	35x4½	SS
1917-18	90	" "	31x4	C
	B 9	" "	33x4½	SS
	85 B 4	" "	32x4	SS
	88-4 and 88 B	" "	34x4½	SS
Owen Magnetic				
1915	All models	" "	35x5	QDC
1916-17	O 36	" "	35x5	QDC
	M 25	" "	34x4½	QDC
Packard				
1915-16	All models	F	36x4½	QDC
		R	37x5	QDC
1917-18	All models	F&R	35x5	QDC
Paige				
1915	All models	" "	34x4	SS
1916	Six-46	" "	34x4	SS
	Six-36	" "	32x4	SS
1917	New Series	" "	35x4½	SS
1918	6-39	" "	32x4	SS
	6-55	" "	35x4½	SS
Pan-American				
1918	G	" "	33x4½	SS
Partin-Palmer				
1915	38	" "	32x3½	SS

CAR	MODEL	TIRE SIZE		TYPE
Partin-Palmer (continued)				
	20	F&R	29x3½	C
1916	38	" "	33x4	SS
	32	" "	32x3½	C
	20	" "	30x3½	C
1917	32	" "	32x3½	C
	20	" "	30x3½	C
Paterson				
1915	4-32	" "	33x4	SS
	6-48	" "	34x4	SS
1916-17-18	All models	" "	32x4	SS
Pathfinder				
1915	All models	" "	34x4½	SS
1916	1 B	" "	35x5	SS
	8 B & Fremont	" "	35x4½	SS
1917	3	" "	35x5	SS
Peerless				
1915	54 DD, 55 EE	" "	34x4	SS
	48-6	" "	37x5	SS
	5 K	" "	36x4½	SS
1916-17-18	56 & 2-56	" "	35x4½	SS
Pennsy				
1916	R	" "	32x4	SS
1917	S	" "	32x4	SS
	T	" "	34x4	SS
1918	B	" "	32x3½	SS
	6 S	" "	33x4½	SS
Phianna				
1918	M	" "	32x4½	QDC
Pierce Arrow				
1915-16	38	" "	36x4½	QDC
	48	" "	37x5	QDC
	66	F	37x5	QDC
		R	38x5½	QDC
1917				
(After June)	38	F&R	34x4½	QDC
	48	" "	35x5	QDC
	66	" "	36x5½	QDC
1918	Same as 1917			

CAR	MODEL	TIRE SIZE		TYPE
Pilgrim				
1917-18	All models	F&R	32x3½	SS
Pilot				
1915	55	" "	34x4	SS
	75	" "	37x4½	SS
1916	6-45	" "	32x4	SS
	55	" "	34x4	SS
	6-75	" "	37x4½	SS
1917-18	6-45	" "	32x4	SS
Premier				
1915-16	All models	" "	36x4½	QDC
1917	All models	" "	35x4½	SS
1918	6 C	" "	32x4½	SS
Princess				
1915	C	" "	28x3	C
1916	D 30	" "	30x3½	C
1917	4-36	" "	32x3½	SS
Pullman				
1915	4-24	" "	30x3½	C
	6-48	" "	36x4½	QDC
1916-17-18	Junior & 4-24-17	" "	31x4	C
Rauch & Lang (Elect.)				
1916-17-18	Pnrematics	" "	33x4½	QDC
	Motz	" "	36x4½	QDC
Regal				
1915	D & 8	" "	33x4	SS
	4-3	" "	30x3½	C
1916	D & F	" "	33x4	SS
	E	" "	30x3½	C
1917	F 8	" "	33x4	SS
	J 4	" "	30x3½	C
1918	6 C	" "	30x3½	C
Reo				
1915-16-17-18	M & N	" "	34x4½	SS
	ST, R, S	" "	34x4	SS
Revere				
1918	18	" "	32x4½	C

CAR	MODEL	TIRE SIZE		TYPE
Roamer				
1916	RAC	F&R	34x4	SS
1917-18	RA	" "	34x4	SS
1917-18	RAC	" "	35x4½	SS
Ross				
1915-16	All models	" "	34x4	SS
1917-18	All models	" "	35x4½	SS
Saxon				
1915	A & B 14	" "	28x3	C
	All other models	" "	32x3½	SS
1916	B 14 & 15-4	" "	28x3	C
	Other models	" "	32x3½	SS
1917	B 5 R	" "	30x3	C
	S 4	" "	32x3½	SS
1918	B 5	" "	28x3	C
	S 4	" "	32x3½	SS
Scripps Booth				
1915	All models	" "	30x3½	C
1916-17-18	C & G	" "	30x3½	C
	D	" "	32x4	SS
Seneca				
1918	A	" "	30x3½	C
Simplex				
1915-16	38, 50 and Crane	F&R	36x4½	QDC
	38, 50 and Crane	R	37x5	QDC
1917	Same as 1916			
	No 1918 models			
Singer				
1915	15	F&R	36x4½	QDC
1916-17-18	All models	" "	35x5	QDC
Standard				
1916-17	8-16 & 17	" "	35x4½	SS
1918	G	" "	34x4½	SS
Stanley Steamer				
1915-16	725	" "	34x4½	QDC
1917	728	" "	34x4½	QDC
1917	730-731	" "	35x4½	SS
1918	730-731	" "	35x4½	SS

CAR	MODEL	TIRE	SIZE	TYPE
States				
1916-17	All models	F&R	32x3½	SS
1918	C 18	" "	31x4	C
Stearns				
1915	L 4	" "	34x4	QDC
	SK 4	" "	36x4½	QDC
	SK 6	" "	37x5	QDC
	SK 8	" "	35x4½	QDC
1917-18	SK 4 open	" "	34x4	SS
	SK 4 closed	" "	32x4	SS
	SK 8	" "	35x4½	SS
Stephens				
1917-18	All models	" "	32x4	SS
Studebaker				
1915	4 SD	" "	33x4	QDC
	6 EC	" "	34x4	QDC
1916-17-18	Four	" "	34x4	SS
	Six	F	34x4	SS
		R	35x4½	SS
Stutz				
1915	HCS	F&R	32x4	SS
	All other models	" "	34x4½	SS
1916	All models	" "	34x4½	SS
1917	C-Bull dog-special	" "	33x5	SS
	All other models	" "	34x4½	SS
1918	All models	" "	32x4½	SS
Velie				
1915	Biltwell	" "	34x4	SS
	4-45 & 6-50	" "	37x4½	SS
1916	22-40	" "	32x4	SS
	15-45	" "	34x4	SS
1917	28	" "	32x4	SS
	27	" "	35x4½	SS
1918	38	" "	32x4	SS
	39	" "	33x4½	SS
Westcott				
1915	O 30 & O 35	" "	33x4	SS
	U 50	" "	35x4½	SS
1916	41 & 42	" "	34x4	QDR
	51	" "	35x4½	QDR

CAR	MODEL	TIRE	SIZE	TYPE
Westcott (Continued)				
1917	4 & 5	F&R	34x4	SS
	7-Passenger	" "	35x4½	SS
1918	7-Passenger	" "	35x4½	SS
White				
1915	30	" "	32x4	QDC
	45	" "	36x4½	QDC
	60	" "	37x5	QDC
1916-17	GAH	" "	32x4	QDC
	GED 45	" "	36x4½	QDC
1918	16 V	" "	35x5	QDC
Willys Knight				
1915	84 T & 84 R	" "	34x4	SS
	84 C & 84 TC	" "	35x4½	SS
	K 17 & K 19	" "	36x4½	SS
1916	84 BT & 84BR	" "	34x4	SS
	All other models	" "	35x4½	SS
1917-18	All models	" "	34x4½	SS
Winton				
1915-16-17-18	21, 22, 48	" "	37x5	QDC
	21 A, 22 A, 33	" "	36x4½	QDC
Woods				
1916-17	44	" "	34x4	QDC
	54	" "	35x4½	QDC
1918	54	" "	35x4½	SS
Yale				
1916-17-18	All models	" "	34x4	SS

Rim abbreviations—SS, straight side; C, Clincher; QDR, Quick Detachable Reversible; QDC, Quick Detachable Clincher.

Index of Tire Sizes

Required by Principal Pleasure Car Models in 1915-1916-1917-1918

This table is obtained by simply cross-indexing from the previous figures showing tire equipment of 1915–16–17 and 18 models. The dealer will find this rearrange-

ment of great value in determining the selling value of each size and type of tire. The author is indebted to the *Horseless Age* and *Tire Rate Book* for much of this equipment data and would recommend that the dealer keep these tables up to date by referring to current files of these publications.

In the table "F" has been used to designate Front wheel and "R" Rear wheel equipment.

TABLE II

INDEX OF TIRE SIZES

28x3 Clincher

(So called "cycle-car" Equipment)

CAR	YEAR	MODEL	WHEEL
Harvard	1917-18	4 2 T	F&R
Princess	1915	C	" "
Saxon	1915-16-17	A, A 4, B 14, 15-4, B 5	" "

30x3 Clincher or QDC

Ford	1915 to 18	T	F only
Metz	1915	22	F&R
Saxon	1917	B 5 R	" "
Monroe	1915-16	All models	" "
Dort	1915-16	4	" "

NOTE.—This size is notable for being standard Ford front equipment.

29x3½ Clincher or QDC

(This size can be ignored)

Partin-Palmer	1915	20	F&R

30x3½ Clincher

(As staple as a dollar bill)

Arbenz	1916-17	25	F&R
Briscoe	1915-16-17	B, 4-24	" "
Campbell	1918	Model 18	" "
Chevrolet	1916-17-18	4-90	" "
Crow-Elkhart	1915	CE Jr	" "
Dort	1915-16-17-18	5, 5 A	" "
Ford	1913 to 18	T	R only
Harroun	1917-18	All models	F&R

30x3½ Clincher (Continued)

CAR	YEAR	MODEL	WHEEL
Maxwell	1915-16-17	25 (open cars)	F&R
Moore	1918	All models	" "
Partin-Palmer	1916-17	20	" "
Princess	1916	D 30	" "
Pullman	1915	4-24	" "
Regal	1915-16-17-18	4 3, E, J 4, 6 C	" "
Scripps Booth	1915-16-17-18	C, G	" "
Seneca	1918	A	" "

NOTE.—This size probably accounts for at least 40% of all the tire business there is.

31x3½ Clincher or QDC

(Oversize for 30 x 3, rarely used and never utilized for original equipment)

32x3½ Clincher or QDC

(The clincher is losing rapidly to the straight side type)

Briscoe	1916	8-38, 4-38	F&R
Metz	1915-16	25	" "
Partin-Palmer	1916-17	32	" "

32x3½ Straight Side

(A fast seller)

Allen	1915-16-17-18	All models	F&R
Buick	1915	C 24	" "
Chevrolet	1915-16	All models	" "
Chevrolet	1917-18	F 5 & F 2	" "
Crow-Elkhart	1916-17-18	CE 30 & 35	" "
Detroiter	1915	C 5	" "
Dixie Flier	1916-17-18	All models	" "
Dodge Bros.	1915-16-17-18	All open cars	" "
Economy	1916-17-18	G 4-36	" "
Empire	1915	All models	" "
Elcar	1916-17	All models	" "
Elgin	1916	All models	" "
Grant	1915-16-17-18	All models	" "
Hollier	1916-17-18	186, 196	" "
Monitor	1916-17-18	C 4, R 4, C	" "
Oakland	1916	32	" "
Partin-Palmer	1915	38	" "
Pilgrim	1917	All models	" "

32x3½ Straight Side (Continued)

CAR	YEAR	MODEL	WHEEL
Princess	1917	4-36	" "
Saxon	1915-16-17-18	B 2, S, S 2, S 4	" "
States	1916-17	All models	" "
Bush	1918	18	" "
Commonwealth	1918	All models	" "
Moon	1918	6-36	" "
Olympian	1918	All models	" "
Pennsy	1918	B	" "

36x3½ QDC

(Seldom used)

Dispatch	1915-16-17-18	All models	F&R

31x4 Clincher or QDC

(Oversize of 30 x 3½ and coming very strong)

Buick	1917-18	D 34, 35; E 34, 35	F&R
Maxwell	1917-18	Closed cars	" "
Overland	1916-17	T 75 & 90; R 75 & 90	" "
Pullman	1916-17	Junior & 424	" "
States	1918	C 18	" "

31x4 Straight Side

Crow-Elkhart	1916-17	CE 33	F&R

(The straight side is rarely seen in 31 x 4)

32x4 Clincher or QDC

(This type is less popular than the straight side, but is to be reckoned with in stock orders.)

Biddle	1915-16-17-18	H, C, D (H, F only, rest	F&R
F R P	1915-16-17	A	F only
Mercer	1915-16-17	Raceabout	F&R
Mercer	1915-16-17	Runabout	" "
Scripps Booth	1916	D	" "
White	1915-16	30 & GAH	" "

32x4 Straight Side

(This tire is coming all the time)

Abbott	1916-17	Touring & Roadster	F&R

32x4 Straight Side (Continued)

CAR	YEAR	MODEL	WHEEL
Abbott	1916	Speedster	" "
Auburn	1915	4-36	" "
Bour-Davis	1918	18 A	" "
Crawford	1918	6-40	" "
Chalmers	1916-17-18	6-30, 35 & 35 A	" "
Economy	1918	C 8-48	" "
Franklin	1917-18	Open cars	" "
Glide	1915	30	" "
Hupmobile	1918	R	" "
Inter State	1918	T	" "
Jackson	1916-17	34, 348, 350	" "
Hatfield	1918	A	" "
Kissel Car	1917	6-38	" "
Lexington	1916-17	6-0 & 0	" "
Liberty	1916-17-18	10 A, 10 B	" "
Marion Handley	1916-17-18	6-40, A 6-40	" "
Mitchell	1916-17-18	D, D 2-40 & 5-40	" "
Monroe	1917-18	M 4, M 5 & M	" "
Nelson	1917-18	All models	" "
Oakland	1917	34	" "
Oldsmobile	1917-18	37	" "
Overland	1917-18	85-4, 85-6	" "
Paige	1916-17-18	6-36 & 39	" "
Paterson	1916-17-18	All models	" "
Pennsy	1916-17	R, S	" "
Pilot	1916	6-45	" "
Stearns	1917-18	SK 4 (closed)	" "
Stephens	1917-18	60, 65, 70, 75	" "
Velie	1916-17-18	22, 28, 38	" "
Stutz	1915	HCS	" "

33x4 Clincher or QDC

(Oversize 32 x 3½)

Crow-Elkhart	1915	E 42	F&R
Studebaker	1915	4 SD	" "
Erie	1916	Roadster & Touring	" "

33x4 Straight Side

(Perpetually popular)

Anderson	1916-17-18	All models	F&R

33x4 Straight Side (Continued)

CAR	YEAR	MODEL	WHEEL
Auburn	1916	4-36	" "
Chevrolet	1918	FA 2, FA 5	" "
Detroiter	1916-17	All models	" "
Dodge	1917	Sedan & Coupe	" "
Erie	1918	33	" "
Economy	1916	C 8-48	" "
Empire	1916-17-18	45, 50, 51	" "
Elgin	1917-18	Roadster & Touring	" "
Hupmobile	1915	H	F&R
Interstate	1915-16-17	All models	" "
King	1915	B	" "
Kissel Kar	1916	432	" "
Monitor	1916-17-18	M 6, 06	" "
Moon	1916	6-30	" "
Oakland	1915-16	37, 38 & Speedster	" "
Oldsmobile	1915-16-17	42, 43, 44, 45	" "
Overland	1915-16	81 T, 83 T, 81 R, 83 BT	" "
Partin-Palmer	1916	38	" "
Paterson	1915	4-32	" "
Regal	1915-16-17	D, 8, F, F 8	" "
Westcott	1915	0-30, 0-35	" "

34x4 QD and Clincher

(Very rarely used as straight side is preferred in this size)

Crawford	1915-16-17	6-35, 6-40	F&R
Crow-Elkhart	1915	E 52	" "
Ohio (Elect.)	1916-17	12	" "
Stearns	1915-16	L 4	" "
Studebaker	1915	6 EC	" "
Westcott	1916	41, 42	" "
Woods	1916-17	44	" "

34x4 Straight Side

(The "King-Pin" of equipment sizes)

Abbott	1915-16-17-18	K & H	F&R
Apperson	1915-16-17-18	6-45, 48; 4-40, 6-16-17-18	" "
Buick	1915-16	C 36, D 44 & 45	" "

34x4 Straight Side (Continued)

CAR	YEAR	MODEL	WHEEL
Buick	1917-18	E 44, 45, 46, 47	" "
Case	1915	R 25, R 30	" "
Case	1916-17	All models	" "
Chalmers	1915-16-17	32, 32 B, 6-30 (7-passenger)	" "
Chandler	1915-16-17-18	All models	" "
Chevrolet	1917	D	" "
Davis	1915-16	38 A, 6 C, F, G	" "
Davis	1917-18	6 H, 6 I, 6 K, H	" "
Empire	1916-17	6-70, 70 A, 71	" "
Glide	1916-17-18	All models	" "
Halladay	1915-16	All models	" "
Halladay	1917-18	RAC, 64	" "
Haynes	1915-16-17	30, 32, 34, 36	" "
Hudson	1915-16	6-40	" "
Hollier	1916-17	178	" "
Hupmobile	1915-16-17	K, 5, N, N 4	" "
Jackson	1915-16-17	46, 349	" "
Jeffrey	1915	493-2, Chesterfield	" "
Jeffrey	1916-17	4-462, 4-472, 6-671	" "
Jones	1915-16-17-18	All models	" "
King	1915-16	D & E	" "
King	1917-18	All models	" "
Kissel Kar	1915-16	4-36, 6-42	" "
Kissel Kar	1917-18	6-42 & 100 PCT	" "
Kline	1915	6-42	" "
Kline	1916-17-18	All models	" "
Lexington	1915-16	4, 6 L, 6 N	" "
Marion-Handley	1915	All models	" "
Madison	1915-16-17-18	All models	" "
Mitchell	1915	B 2-35, 5-35, 6-35	" "
Mitchell	1916-17-18	8, 6, Big 6, C 42	" "
Moline	1915-16-17-18	40	" "
Moon	1915	4-38, 6-40	" "
Moon	1916-17-18	6-40, 6-43, 6-45	" "
Oldsmobile	1917-18	45 7-passenger	" "
Overland	1915	80 T, 80 R	" "

34x4 Straight Side (Continued)

CAR	YEAR	MODEL	WHEEL
Paige	1915	6-36, 6-46	" "
Paige	1916	6-46	" "
Paterson	1915	6-48	" "
Peerless	1915	54 DD, 55 EE	" "
Pennsy	1917	T	" "
Pilot	1915-16	55	" "
Auburn	1915-16	6-40 & 6-38	" "
Auburn	1917-18	6-39 C	" "
Auburn	1917-18	6-44	F only
Ghent	1918	6-60	F&R
Nash	1918	All models	" "
Oakland	1918	34 B	" "
Reo	1915-16-17	ST, R, S	F&R
Roamer	1916-17	RAC & 64	" "
Ross	1915	All models	" "
Ross	1916	All models	" "
Stearns	1917	SKL 4 Open	" "
Studebaker	1915	6 EC	" "
Studebaker	1916	Four	" "
Studebaker	1916	Six	F only
Velie	1915-16	Biltwell 15-45	F&R
Westcott	1917	4 & 5-passenger	" "
Willys-Knight	1915	84 T & R	" "
Willys-Knight	1916	84 BT & BR	" "
Yale	1916-17	All models	" "

36x4 QDC

(Passing out)

Crow-Elkhart	1915	E 62	F&R
F R P	1915	B	F only

36x4 Straight Side

(Very rare)

Arbenz	1915	All models	F&R
Mitchell	1915	B 2-45, B 5-45, B 6-45	" "
Apperson	1915	4-45, 6-60	" "

32x4½ Straight Side
(Oversize of the oversize 31 x 4)

CAR	YEAR	MODEL	WHEEL
Hudson	1917-18	Speedster	F&R
Premier	1918	6 C	" "

32x4½ QDC and Clincher
(Oversized oversize)

Marmon	1917-18	34 Coupé	F&R
Phianna	1918	M	" "
Stutz	1918	——	" "
Revere	1918	All models	" "

33x4½ QDC and Clincher
(Oversize of 32 x 4)

Biddle	1917	H	R only
F R P	1915-16-17	A	" "
Rauch & Lang (Elect.)	1916-17-18	Pneumatics	F&R

33x4½ Straight Side
(Oversize 32 x 4)

Bour-Davis	1918	18 B	F&R
Abbott	1916-17	Sedan	" "
Marion-Handley	1916	6-60	" "
Overland	1917	85 SN, 85-6 SN	" "
Pan-American	1918	G	" "
Pennsy	1918	6 S	" "

34x4½ QDC and Clincher
(Popular equipment for Medium and High Priced cars)

Austin	1915-16-17	All models	F&R
Daniels	1916-17	8, AB	" "
Detroit (Elect.)	1915-16-17	All models	" "
Jackson	1916	68	" "
Marmon	1916-17	34 & Touring	" "
Mercer	1915-16-17-18	Sport & Touring	" "
Mercer	1916-17	Limousine	F only
National	1916-17-18	Highway 12, 6	F&R
Murray	1917	All models	" "
Ohio (Elect.)	1916-17	42, 43, 60, 63	" "
Owen Magnetic	1916-17	M 25	" "
Pierce Arrow	1917	38 After June	" "
Stanley Steamer	1915-16-17	725, 728	" "

34x4½ Straight Side

(Runs about 50-50 with the QD type)

CAR	YEAR	MODEL	WHEEL
Austin	1918	12	F&R
Brewster	1915-16-17-18	All models	" "
Buick	1918	E 49, E 50	" "
Chalmers	1915-16	26 B	" "
Davis	1916-17	6 E, 6 J, 6 JL	" "
Franklin	1915-16	M8 and closed	" "
Haynes	1917	40, 41	" "
H A L	1917	21	" "
Jackson	1915	48-6	" "
Jeffrey	1915	6-106	" "
Kissel Kar	1917	Double 6	" "
Daniels	1918	All models	" "
Oakland	1916-17	50	F&R
Pathfinder	1915	7 B	" "
Reo	1915-16-17	M, N	" "
Stutz	1915	Bear Cat, 6, T	" "
Stutz	1916	C and New C	" "
Stutz	1917	Bear Cat, Roadster, Touring	" "
Willys-Knight	1917	All models	" "
Standard	1918	G	" "

35x4½ QDC

(Oversize 34 x 4, Fading out on QDC)

Premier	1917	6 B	F&R
Stearns	1916	SK 8	" "
Westcott	1916	51	" "
Woods	1916-17	54	" "

35x4½ Straight Side

(At the peak of its popularity)

Woods	1918	54	F&R
Abbott	1915-16	F, 8-80	" "
Apperson	1916-17	8-16, 8-17	" "
Auburn	1916	6-40 A	" "
Auburn	1917	6-44	R only
Cole	1915	All models but 6-66	F&R
Cole	1916	All models	" "

35x4½ Straight Side (Continued)

CAR	YEAR	MODEL	WHEEL
Halladay	1917	RAC 66	F&R
Haynes	1915-16-17	33, 35, 37	" "
Hudson	1917	Super 6	" "
Hupmobile	1916-17	7, NQ, NU	" "
Jeffrey	1916	6-661	" "
Jordan	1917	4, 7	" "
Kissel Kar		6-42 (7)	" "
Marion-Handley	1917	6-60	" "
Moline-Knight	1917	MK, 50, G	" "
Moon	1915-16-17	6-50, 6-66	" "
Oakland	1915	49	" "
Overland	1915-16-17	82 T, 80 C, 86 T, 88-6 T	" "
Paige	1917	All models	" "
Paige	1918	6-55	" "
Pathfinder	1916	8 B & Fremont	" "
Peerless	1916-17	56, 2-56	" "
Roamer	1917	RAC 66	" "
Ross	1917	All models	" "
Standard	1916-17	8-16, 8-17	" "
Stanley Steamer	1917-18	730, 731	" "
Stearns	1917-18	SK 8	" "
Studebaker	1916	Six	R only
Velie	1917	27	F&R
Westcott	1915-17	U 50, 7-pass.	" "
Willys-Knight	1915-16	84 C, 84 TC, 84 B, 84BC	" "
Case	1917	U	" "
Case	1918	All models	" "

36x4½ QDC
(Slipping)

* Cadillac	1915	All models	F&R
Dorris	1915-16-17	IA 4	" "
* F I A T	1915-16-17	54, 55, 56, 6-50	F only
F. R. P.	1916-17-18	B	" "
Locomobile	1915	M 5, R 4	" "
Locomobile		Roadster	F&R
Locomobile	1916	R 6-38	F only
Locomobile		Roadster	F&R

36x4½ QDC (Continued)

CAR	YEAR	MODEL	WHEEL
Locomobile	1917	R 7-38	F only
* McFarlan	1915	T, X	F&R
* Marmon	1915-16	48	F only
* Marmon		41	F&R
* National	1915-16	AB, Highway 12, Newport	" "
* Packard	1915-16	All models	F only
* Pierce Arrow	1915-16	38	F&R
* Premier	1915-16	6-50, 6-56	" "
* Pullman	1915	6-48	F&R
Simplex	1915-16	38, 50, Crane	F only
* Singer	1915	6-15	F&R
* Stearns	1915	SK 4	" "
* White	1915-16	45 GED	" "
Winton	1915-16-17-18	21 A, 22 A, 33	" "

* Marks cars that have discarded this type or size, in part, if not completely.

36x4½ Straight Side
(Dropping off)

* Abbott	1915	L	F&R
* Buick	1915-16	C 54 (5) & D 55	" "
* Chalmers	1915-16	M 6-29	" "
* Haynes	1915	31	" "
* Hudson	1915	6-54	" "
* Kissel Kar	1915	6-48	" "
* Lexington	1915 & 1917	6 M & P	" "
Lozier	1916	82, 84, 6-50	
Lozier	1917-18	All models	" "
* Mitchell	1915	5 P 6	" "
* Moline	1915-16	Knight 50	" "
* Willys-Knight	1915	K 17, K 19	" "
* Cadillac	1916-17	53 & 55	" "
* Dorris	1915	1 A 6	" "
* Dorris	1916-17-18	1 B 6	" "
Peerless	1915	5 K	" "

* Marks cars that have discarded this size of late.

37x4½ QDC
(DEAD)

37x4½ Straight Side

(Scarcer and Scarcer—Petered out after 1915)

CAR	YEAR	MODEL	WHEEL
Auburn	1915	6-47	F&R
Davis	1915	6 D	" "
Pilot	1915-16	75, 6-75	" "
Velie	1915	4-45, 6-50	" "

38x4½ QDC Only

(Now totally extinct)

33x5 QDC

(Over size of oversize of oversize of 31 x 4—bears watching)

Marmon	1917	Closed	F only

33x5 Straight Side

(Has better possibilities than the QDC type)

Stutz	1917	Bulldog Special	F&R

35x5 QDC

(Over size of 34 x 4½—a "comer")

Cunningham	1918	All models	F&R
F. I. A. T.	1918	All models	" "
Locomobile	1917	R 7	" "
McFarlan	1916-17	X	" "
Mercer	1916-17	Limousine	R only
Owen Magnetic	1915-16-17	O 36	F&R
Packard	1917-18	2-25, 2-35	" "
Pierce Arrow	1917-18	48	" "
Singer	1916-17	6-16, 6-17	" "
White	1918	1-6 Y	" "

35x5 Straight Side

Cadillac	1918	57	F&R
Pathfinder	1916	I B & 3	" "

36x5 QDC

(Very scarce)

F R P	1915-16-17-18	B	R only

* NOTE.—The straight side type is absolutely obsolete and has not appeared since used on the 1915 Oldsmobile model 55.

37x5 QDC

(Big car favorite—now fading fast)

CAR	YEAR	MODEL	WHEEL
* Cole	1915	6-66	F&R
* Cunningham	1915-16-17	All models	" "
* F I A T	1915-16-17	54, 55, 56, 6-50	R only
Locomobile	1915	M 5, R 4	" "
Locomobile	1916	M 6, 40	F&R
Locomobile	1916	R 6-38	R only
Locomobile	1917	R 7-38	" "
Locomobile	1917	M 7-48	F&R
* Marmon	1915	48	R only
* Packard	1915-16	38, 48, 25, 35	" "
* Peerless	1915	48-6	F&R
* Pierce Arrow	1915-16	48	" "
* Pierce Arrow		66	F only
Lyons Knight	1915-16-17	All models	F&R
* Simplex	1915-16-17	38, 50 Crane	R only
* Stearns	1915-16	SK 6	F&R
* White	1915	60	" "
* Winton	1915-16-17-18	21, 22, 48	" "

* Indicates cars that have discarded 37x5 QD in part or completely (eleven out of thirteen). A word to the wise, etc.

37x5 Straight Side

(Never popular and now dead)

Kissel Kar	1915	6-60	F&R

38x5 QDC or Straight Side

(Dead on all sizes and types)

36x5½ QDC

(Oversize of oversize 35 x 5)

Pierce Arrow	1918	66	F&R

37x5½ QDC or Straight Side

(Dead on all sizes and types)

38x5½ QDC

(Practically extinct)

Pierce Arrow	1915-16-17	66	R only

NOTE.—This size is an oversize of the oversize 37x5

and has been kept alive only through use on the rear wheels of the Pierce Arrow 66. This Company has now discontinued its use, which makes it a dead issue for the future.

TABLE III

Approximate Percentages of Clincher, QDC and Straight Side Types to Total Number of Tires Made in 1916

Clincher	52%
QD Clincher	2%
Straight side	46%
	= 100%

The percentages for 1917 will be approximately the same.

Notes on Ordering

It is the prime aim of every business man to have his merchandise inventory in complete harmony with current and future demand. If it is not, then certainly a depreciation loss must be written off sooner or later, but *if it is*, the stock can be figured correctly at 100 cents on the dollar. The statistics given on previous pages, while interesting in themselves and valuable for reference, perform their greatest service in giving a sound basis for the preparation of stock orders.

For instance, the table showing the tire requirements of the principal cars indexed as to the size and type of each tire is especially valuable. By checking against such car models that are particularly prevalent in the dealer's own district he will obtain a bird's eye view of the demand to be expected in his locality. This makes it possible for him to stock his tires in complete harmony with demand and will result in a well balanced and very

liquid stock. The immediate effect on service will be beneficial and in addition he will be able to do a relatively larger business in proportion to the capital invested.

Many dealers have succeeded in reducing the matter of tire ordering to an almost exact science—and they are invariably prosperous. They start by drawing up tables showing the exact distribution of their stock for three or four periods in the year—say March 1, July 1 and Dec. 1. This will represent the total number of tires (divided as to size and type) that *should be* on hand at each period. Before ordering, a comparison with the *actual* inventory is drawn off and the difference between normal stock desired and actual stock on hand constitutes the order to be placed. This absolutely prevents over-buying and gives automatic information as to those tires that are not selling up to the original expectations. Necessary changes can then be made in the Normal stock tables so as to avoid repeating the error, and sales emphasis can be concentrated towards selling the surplus sizes on hand.

The Distributing Medium

The amount of business done by the average tire dealer bears a direct relation to the total amount of business done, and the number of competing dealers who share in this total distribution. Table IV shows the car registration by states which indirectly yields the approximate figures for the total tire sales for each state. Table VI shows the total distributing mediums, also itemized by states, so the dealer can readily ascertain the amount of business done in his state and the number of dealers who share in it. This puts him in a position to ascertain at once whether he is above or below the average,

and he can take prompt action accordingly. In connection with Table V there is considerable duplication—that is, a man who combines the functions of dealer, garage and machine shop in one place of business is counted not once, but three times. This has been taken into account, however, and corrected so that the figures in the extreme right hand column represent the *net total* of all tire dealers.

TABLE IV

Car and Truck Registration in Each State from Jan. 1, 1916, to Jan. 1, 1917

State or Territory	Total Registration	New Registration	Registration Up to Jan. 1, 1916
Alabama	22,354	8,556	13,798
Arizona	12,122	4,802	7,320
Arkansas	14,979	6,958	8,021
California	232,186	68,385	163,801
Colorado	44,180	17,569	26,611
Connecticut	56,048	17,098	38,950
Delaware	7,520	2,596	4,924
Dist. of Col.	13,118	2,918	10,200
Florida	14,220	1,097	13,123
Georgia	46,025	21,966	24,059
Idaho	13,283	6,190	7,093
Illinois	251,300	69,010	182,290
Indiana	139,138	42,223	96,915
Iowa	198,587	58,779	139,808
Kansas	114,364	39,408	74,956
Kentucky	31,500	12,000	19,500
Louisiana	16,800	5,920	10,880
Maine	30,951	12,351	18,600
Maryland	43,864	16,226	27,638
Massachusetts	136,809	47,676	89,133
Michigan	160,052	45,207	114,845
Minnesota	138,000	46,171	91,829
Mississippi	20,474	8,974	11,500
Missouri	107,865	31,403	76,462
Montana	24,585	10,065	14,520
Nebraska	101,201	42,061	59,140
Nevada	4,672	2,495	2,177
New Hampshire	17,508	6,689	10,819
New Jersey	104,341	36,785	67,556
New Mexico	8,228	3,281	4,947
New York	316,543	103,699	212,844
North Carolina	35,200	14,040	21,160
North Dakota	41,761	17,083	24,678
Ohio	258,409	78,642	179,767
Oklahoma	52,718	27,103	25,615
Oregon	33,917	10,159	23,758
Pennsylvania	230,648	79,919	150,729
Rhode Island	21,406	5,044	16,362
South Carolina [1]	19,000	4,500	14,500
South Dakota	44,271	14,935	29,336
Tennessee	31,700	4,434	27,266
Texas [2]	197,687	59,880	137,807
Utah	13,507	5,513	7,994
Vermont	15,671	4,172	11,499
Virginia	35,426	14,069	21,357
Washington	62,546	25,641	36,905
West Virginia	20,437	7,181	13,256
Wisconsin	117,603	36,232	81,371
Wyoming	7,125	3,149	3,976
Total	3,681,849	1,210,254	2,471,595

NOTE.—Steam cars and trucks, as well as electric vehicles, included with the gasoline vehicle statistics as segregation is not carried out by registration officials. [1] Estimated by state registration officials. [2] Texas statistics for Jan. 1, 1916, now available, 137,807; previous estimate was only 90,000.

TABLE V

Registration and Population

State	Pop. July 1, 1916 Census	Cars and Trucks	Pop. Per Car
Iowa	2,220,321	172,791	13
Nebraska	1,271,375	101,201	13
California	2,938,654	212,918	14
Kansas	1,829,545	114,364	16
South Dakota	698,509	44,271	16
Minnesota	2,279,603	137,500	17
North Dakota	739,201	41,761	18
Arizona	355,544	12,122	19
Michigan	3,054,854	159,639	19
Montana	459,494	24,585	19
Indiana	2,816,817	139,138	20
Ohio	5,150,356	252,179	20
Wisconsin	2,500,350	117,603	21
Colorado	962,060	44,180	22
Connecticut	1,244,479	56,048	22
Texas	4,429,566	197,687	22
Nevada	106,734	4,609	23
Wyoming	179,559	7,125	25
Illinois	6,152,257	251,300	25
Washington	1,534,221	62,546	25
Vermont	363,699	14,251	26
Maine	772,489	28,951	27
Massachusetts	3,719,156	136,790	27
Oregon	835,741	30,917	27
Delaware	213,380	7,520	28
Dist. of Col.	363,980	13,118	28
Rhode Island	614,315	21,406	29
New Hampshire	442,506	14,338	31
Missouri	3,410,692	107,865	32
Utah	434,083	13,507	32
Idaho	428,586	12,996	33
Pennsylvania	8,522,017	230,648	37
New York	10,273,375	279,406	37
New Jersey	2,948,017	75,108	39
Maryland	1,362,807	33,364	41
Oklahoma	2,202,081	52,718	42
New Mexico	410,283	8,028	50
Virginia	2,192,019	35,426	62
Georgia	2,856,065	45,775	62
Florida	893,493	14,220	63
North Carolina	2,402,738	35,150	68
West Virginia	1,386,038	20,437	68
Tennessee	2,288,004	31,400	73
Kentucky	2,379,639	31,500	76
South Carolina	1,625,475	19,000	86
Mississippi	1,951,674	20,474	95
Alabama	2,332,608	22,354	104
Louisiana	1,829,130	16,800	108
Arkansas	1,730,723	14,704	118
Total	102,017,312	3,541,738	
Average for U. S.			29

TABLE VI
Dealers, Garages, Machine Shops and Supply Houses in the United States

January 1, 1917

State	Dealers	Garages	Machine Shops	Cos. Having Supply Dept.	Supplies Exclusively	Total
Alabama	172	109	74	37	35	278
Arizona	86	82	51	24	12	152
Arkansas	174	96	59	29	18	245
California	1,096	1,211	739	200	151	2,032
Colorado	346	312	177	80	22	520
Connecticut	394	431	211	50	70	713
Delaware	65	62	27	11	5	90
Dist. of Columbia	57	56	36	8	24	140
Florida	246	272	163	64	45	464
Georgia	315	266	123	33	46	549
Idaho	151	100	53	23	19	207
Illinois	1,857	1,645	968	390	131	2,889
Indiana	984	795	409	247	65	1,497
Iowa	1,619	1,322	681	360	64	2,196
Kansas	986	774	380	266	33	1,445
Kentucky	291	230	82	62	24	413
Louisiana	120	67	45	31	18	170
Maine	279	262	124	80	19	456
Maryland	222	242	125	75	36	403
Massachusetts	771	818	421	180	141	1,520
Michigan	986	822	349	132	88	1,535
Minnesota	1,155	833	458	271	59	1,550
Mississippi	133	84	50	40	13	193
Missouri	810	639	413	222	81	1,310
Montana	240	205	117	60	14	345
Nebraska	810	647	285	218	29	1,091
Nevada	57	52	28	19	4	84
New Hampshire	192	214	107	59	10	319
New Mexico	102	73	42	33	78	223
New Jersey	621	844	411	192	6	1,170
New York	2,003	2,217	1,172	456	321	3,735
North Carolina	306	233	111	85	21	421
North Dakota	537	339	198	119	9	703
Ohio	931	1,347	542	425	172	2,589
Oklahoma	386	311	125	136	27	581
Oregon	205	231	130	49	30	315
Pennsylvania	1,677	1,682	776	452	113	2,673
Rhode Island	85	141	91	16	19	262
South Carolina	156	113	58	48	19	248
South Dakota	442	308	155	35	7	584
Tennessee	188	136	75	20	40	285
Texas	626	488	267	47	87	1,059
Utah	88	62	33	15	15	143
Vermont	187	156	83	33	11	286
Virginia	230	158	111	41	44	391
Washington	356	318	168	25	54	599
West Virgini	199	143	52	24	13	246
Wisconsin	1,016	874	410	135	47	182
Wyoming	76	56	37	13	2	103
Hawaii	6	7	3	....	1	9
West Indies	25	20	5	1	1	32
Canada	854	760	358	3	95	1,252
Mexico	8	11	3	1	2	15
Total	25,924	23,686	12,171	5,675	2,503	40,912

Who's Who in Tiredom

Being a list of the pneumatic tire and tube manufacturers of the United States, corrected to July 1, 1917.

Acme Rubber Mfg. Co.,
Trenton, N. J.
Plain, Kam, Dimple, Hemisphere Tubes

Advance Rubber Co.,
Brooklyn, N. Y.
Plain
Non-Skid, Gray Tubes

Ajax Rubber Co., Inc.,
New York, N. Y.
Plain, Non-Skid, Gray Tubes, Red Tubes

Amazon Rubber Co.,
Akron, O.
Non-Skid, Brown Tubes

American Rubber Corp.,
New York City.
Plain and Non-Skid Tires, Red and Gray Tubes

American Rubber & Tire Co.,
Akron, O.
Plain, Non-Skid, Gray Tubes, Red Tubes

Anderson Rubber Works,
Anderson, Ind.
Plain, Non-Skid, Extra-Ply Plain, Extra-Ply Non-Skid, Cord Plain, Cord Non-Skid, Gray Tubes, Red Tubes

Archer Cord Tire & Rubber Co.,
Minneapolis, Minn.
Ribbed, Non-Skid, Gray Tubes, Red Tubes

Armstrong Rubber Co.,
Newark, N. J.
Red Tubes only

Baltimore Rubber Tire Mfg. Co.,
Baltimore, Md.
Plain and Non-Skid Tires, Red and Gray Tubes

Batavia Rubber Co.,
Batavia, N. Y.
Plain, Security Non-Skid, Gray Tubes

Beacon Tire Co.,
Beacon, N. Y.
Rib Skid, Red Tubes

Bergougnan Tire Corp.,
New York, N. Y.
Plain, Non-Skid, Red Tubes

Besaw Tire & Rubber Co.,
Hartville, O.
Plain, Non-Skid, Blackford Non-Skid, Blackford Gray Tubes, Red Tubes

Boone Tire & Rubber Co.,
Sycamore, Ill.
Plain and Non-Skid Tires, Red and Gray Tubes

Bowers Rubber Works,
San Francisco, Cal.
Plain, Non-Skid, Gray Tubes

Braender Rubber & Tire Co.,
Rutherford, N. J.
Plain, Non-Skid, Gray Tubes, Red Tubes

Brunswick-Balke-Collender Co.,
Chicago, Ill.
Plain, Non-Skid, Red Tubes

Bucyrus Rubber Co.,
Bucyrus, O.
Plain, Non-Skid, Gray, Red Tubes

Carlisle Cord Tire Co.,
New York City.
Cord Non-Skid only

Century Rubber Works,
Chicago, Ill.
Plain, Non-Skid, Gray Tubes, Red Tubes

Columbia Tire & Rubber Co.,
Columbiana, O.
Plain, Non-Skid, Gray Tubes, Red Tubes

Combination Rubber Mfg. Co.,
Bloomfield, N. J.
Plain, Hold-On Non-Skid, Gray Tubes, Red Tubes

Community Rubber Co.,
Morrisville, Pa.
Delaware Plain, Non-Skid, Gray Tubes

Compression Inner Tube Co.,
Louisville, Ky.

Continental Rubber Works,
Erie, Pa.
Plain, Non-Skid, Gray Tubes, Red Tubes, Black Tubes

Converse Rubber Shoe Co.,
Malden, Mass.
Plain, Non-Skid, Gray Tubes, Red Tubes

Cortland Tire & Rubber Co.,
Belleville, N. J.
C. C. Plain, C. C. Non-Skid, Regular Plain, Gripper Non-Skid

Cupples Company,
St. Louis, Mo.
Non-Skid, Tubes

Dayton Rubber Mfg. Co.,
Dayton, O.
Plain, Non-Skid, Red Tubes

Defiance Tire & Rubber Co.,
Chicago, Ill.
Plain and Non-Skid Tires, Red and Gray Tubes

Delion Tire & Rubber Co.,
New York, N. Y.
Plain, Non-Skid, Red Tubes

Double Fabric Tire Co.,
Auburn, Ind.
Xtra-Pli, Brazil Gray Tubes

Dreadnought Tire & Rubber Co.,
Baltimore, Md.
Non-Skid, Ribbed Tread, Red Tubes

Dry Climate Tire & Rubber Co.,
Arvara, Col.
Plain and Non-Skid Tires, Red and Gray Tubes

Duplex Tire Co.,
New York, N. Y.
Plain, Non-Skid, Red Tubes

Dural Rubber Corp.,
Flemington, N. J.
Red and Gray Tubes only

East Palestine Rubber Co.,
East Palestine, O.
Plain, Non-Skid, Red Tubes

Ehman Tire & Rubber Co.,
Chicago, Ill.
Plain, Non-Skid, Gray Tubes, Red Tubes

Empire Rubber & Tire Co.,
Trenton, N. J.
Gray Plain, Gray Non-Skid, Gray Tubes, Red Plain, Red Non-Skid, Red Tubes, Peerless Tubes

Endurance Tire & Rubber Co.,
New Brunswick, N. J.
Non-Skid, Gray Tubes, Red Tubes

Eureka Tire Co.,
Trenton, N. J.
Plain, Non-Skid, Gray Tubes, Red Tubes

Essex Rubber Co.,
Trenton, N. J.
Gray Tubes, Red Tubes

Falls Rubber Co.,
Cuyahoga Falls, Ohio
Plain, Non-Skid, Red Tubes

Federal Rubber Co.,
Cudahy, Wis.
Plain, Traffic, Rugged, Gray Tubes, Red Tubes

Fellsen Tires, Inc.,
New York City.
Plain, Non-Skid Tubes

Firestone Tire & Rubber Co.,
Akron, O.
Plain, Non-Skid, Gray Tubes, Red Tubes

Fisk Rubber Co.,
Chicopee Falls, Mass.
Plain, Non-Skid, Red Top Non-Skid, Gray Tubes, Red Tubes

General Tire & Rubber Co.,
Akron, O.
Plain, Non-Skid, Gray Tubes, Red Tubes

Giant Tire Co.,
Akron, O.
Non-Skid, Gray Tubes

Gillette Rubber Co.,
Eau Claire, Wis.
Plain, Non-Skid, Gillette Safety Gray Tubes, Red Tubes

Globe Rubber Tire Mfg. Co.,
Trenton, N. J.
Plain, Non-Skid, Red Tubes, Gray Tubes

Goodrich Co., B. F.,
Akron, O.
Plain, Non-Skid, Gray Tubes, Brown Tubes, Straightside Silvertown Ribbed Tread, Q. D. Silvertown Ribbed Tread, Straightside Silvertown Safety Tread, Q. D. Silvertown Safety Tread

Goodyear Tire & Rubber Co.,
Akron, O.
Plain, All Weather Non-Skid, Regular Tubes, Heavy Tubes, Cord Ribbed, Cord Non-Skid

Gordon Tire & Rubber Co.,
Canton, O.
Plain, Non-Skid, Gray Tubes, Red Tubes

Great Eastern Rubber Co.,
Allentown, Pa.
Crown Plain, Non-Skid, Gray Tubes, Red Tubes

Gryphon Rub. & Tire Corp.,
New York, N. Y.
Plain, Non-Skid, Gray and Red Tubes

Hamilton Rub. Mfg. Co.,
Trenton, N. J.
Non-Skid, Pure Gum Tubes, Perfection Pink Tubes

Hardman Tire & Rubber Co.,
Belleville, N. J.
Junior Plain, Junior Non-Skid, Junior Tubes, Plain, Non-Skid, Red Tubes

Hawkeye Tire & Rubber Co.,
Des Moines, Iowa.
Plain and Non-Skid Tires, Red and Gray Tubes

Hendrie Rubber Co., W. C.,
Torrance, Cal.
Plain, Inset Non-Skid, California Non-Skid, Gray Tubes, California Red Tubes

Hercules Tire Co.,
New York, N. Y.
Plain, Non-Skid Tubes

Hood Rubber Co.,
Watertown, Mass.
Plain, Arrow Non-Skid, Puritan Plain, Puritan Non-Skid, Hood Tubes, Puritan Tubes

Howe Rubber Co.,
New Brunswick, N. J.
Plain, Non-Skid, Gray Tubes, Red Tubes

Indiana Rubber & Ins. Wire Co., Jonesboro, Ind.
Plain, Non-Skid, Gray Tubes, Brown Tubes

Kansas City Tire & Rubber Corp., Kansas City, Kan.
Chester Plain, Chester Non-Skid, Bull Plain, Bull Non-Skid, Gray Tubes, Red Tubes

Keaton Tire & Rubber Co.,
San Francisco, Cal.
Plain, Non-Skid, Red Tubes

Kelly-Springfield Tire Co.,
Akron, O.
Plain, Driving Tread, Kant Slip Non-Skid, Gray and Red Tubes

Knight Tire & Rubber Co.,
Canton, O.
Blackstone Plain, Knight Plain, Non-Skid, Silver King Tubes, Knight Tubes

Kokomo Rubber Co.,
Kokomo, Ind.
Plain, Non-Skid, Standard Gray, Standard Red, Everlaster Gray, Everlaster Red

Lancaster Tire & Rubber Co., Lancaster, O.
Clingstone Plain, Clingstone Non-Skid, Clingstone Gray Tubes, Wiregrip Plain, Wiregrip Non-Skid, Wiregrip Gray Tubes

Lee Tire & Rubber Co., Conshohocken, Pa.
Plain, Non-Skid, Puncture Proof Plain, Puncture Proof Non-Skid, Gray Tubes, Red Tubes

L. & M. Rubber Co., Carrollton, O.
Plain, Non-Skid, Gray Tubes, Red Tubes

Mansfield Tire & Rubber Co., Mansfield, O.
Plain, Non-Skid, Gray Tubes, Red Tubes

Marathon Tire & Rubber Co., Cuyahoga Falls, O.
Runner Tread, Angle Tread, Cord Runner, Cord Angle, Gray Tubes, Red Tubes

Marion Tire & Rubber Co., Marion, O.
Plain, Non-Skid Tires, Red and Gray Tubes

McCreary Tire & Rubber Co., Indiana, Pa.
Plain and Non-Skid Tires, Red and Gray Tubes

McGraw Tire & Rubber Co., East Palestine, O.
Imperial Plain, Pullman Non-Skid, Congress Gray Tubes, Red Tubes

McLean Tire & Rubber Co., East Liverpool, O.
Non-Skid, Tubes

McNaull Tire Co., Toledo, O.
Non-Skid Tires, Red and Gray Tubes

Mason Tire & Rubber Co., Kent, O.
Plain, Ribbed, Non-Skid, Gray Tubes, Red Tubes

Mattson Rubber Co., Lodi, N. J.
Plain, Non-Skid, Gray Tubes

Michelin Tire Co., Milltown, N. J.
Plain, Universal, Tubes

Mohawk Rubber Co., Akron, O.
Plain, Ribbed, Non-Skid, Red Tubes, Keaton Non-Skid

Mutual Tire & Rubber Co., New York, N. Y.
Plain, Non-Skid, Red Tubes

National Rubber Co., Pottstown, Pa.
Non-Skid, Tubes

National Tire Co., Trenton, N. J.
Plain, Non-Skid, Gray Tubes, Red Tubes

National Tire & Rubber Co., East Palestine, O.
Capitol Plain, Capitol Non-Skid, Record Non-Skid, Highway Non-Skid, Paragum Gray Tubes, Redman Tubes

Needham Tire Co., Charles River, Mass.
Plain, Non-Skid, Tubes

New Castle Rubber Co., Pittsburgh, Pa.
Plain, Non-Skid, Shenango Non-Skid, Pure Gum Gray Tubes

New Jersey Car Spring & Rubber Co., Jersey City, N. J.
Carspring Plain, C. Tread, Suction Tread, Gray Tubes, Red Tubes

Norwalk Tire & Rubber Co., Norwalk, Conn.
Plain, Non-Skid, Gray Tubes, Red Tubes

Ohio Tire & Rubber Co.,
Mansfield, O.
Plain, Non-Skid, Gray Tubes, Red Tubes

Orrville Rubber Co.,
Orrville, O.
Plain, Non-Skid, Gray Tubes, Sealon Red Tubes

Palmer Tire & Rubber Co.,
St. Joseph, Mo.
Tubes only

Para-Ball Rubber Co.,
Columbiana, O.
Plain, Non-Skid, Gray Tubes, Red Tubes

Pierce-Arrow Tire & Rubber Mfg. Co.,
Philadelphia, Pa.
Morton Plain, Non-Skid, Germantown Cord Plain, Non-Skid, Blow-Out Proof Plain, Non-Skid, Red Tubes

Peerless Tire & Rubber Co.,
Green Bay, Wis.
Non-Skid, Gray Tubes, Red Tubes

Pennsylvania Rubber Co.,
Jeanette, Pa.
Bar Circle, Ebony, Vacuum C, Gray Tubes

Perfection Tire & Rubber Co.,
Chicago, Ill.
Plain, Non-Skid, Tubes

Perfection Tube Co.,
Painesville, O.
Gray Tubes, Red and Brown Tubes

Pharis Tire & Rubber Co.,
Newark, O.
Plain, Non-Skid, Gray Tubes, Red Tubes

Portage Rubber Co.,
Akron, O.
Plain, Daisy Non-Skid, Tubes

Porter Rubber Co.,
Salem, O.
Tubes, Red Tubes
Giant, Non-Skid, Gray

Quaker City Rubber Co.,
Philadelphia, Pa.
Plain, "T. T. T." Non-Skid, Gray Tubes, Red Tubes

Racine Auto Tire Co.,
Racine, Wis.
Plain, Non-Skid, Horse Shoe Cord, Gray Tubes, Red Tubes

Racine Rubber Co.,
Racine, Wis.
Plain, Country Road Non-Skid, Trusty Non-Skid, Ribbed Cord, Non-Skid Cord, Gray Tubes, Red Tubes

Republic Rubber Co.,
Youngstown, O.
Plain, Staggard Non-Skid, WM Non-Skid, Gray Tubes, Red Tubes

Revere Rubber Co.,
Providence, R. I
Plain, Non-Skid, Gray Tubes, Red Tubes

Rubber Ins. Metals Co.,
Plainfield, N. J.
Plain, Non-Skid, "Century" Red Tubes

Rubber Products Co.,
Barberton, O.
Plain, Stronghold Non-Skid, Gray Tubes, Red Tubes

Savage Tire Co.,
San Diego, Cal.
Plain, Non-Skid, Grafinite Tubes

Schavoir Rubber Co.,
Stamford, Conn.
Gray Tubes, Red Tubes, Jumbo Red Tubes

Semple Rubber Co.,
Trenton, N. J.
Semco Red Tubes

Southern Tire & Rubber Co.,
Augusta, Ga.
Plain and Non-Skid Tires, Red Tubes only

Star Rubber Co.,
Akron, O.
Ribbed, All Star Non-Skid, Pure Gum Tubes

Standard Four Tire Co.,
Keokuk, Ia.
Plain, Non-Skid, Gray Tubes, Red Tubes

Standard Tire & Rubber Mfg. Co.,
Cleveland, O.
Plain, Non-Skid, Red Tubes, Gray Tubes, Velvet-tread Plain, Non-Skid, Red Tubes, Gray Tubes

Sterling Tire Corp.,
Rutherford, N. J.
High Bar and Special Red Tubes

Smith Canvas Tread Tire Co.,
Utica, N. Y.
Tubes

Swinehart Tire & Rubber Co.,
Akron, O.
Plain, Ribbed, Non-Skid Tubes

Thermoid Rubber Co.,
Trenton, N. J.
"Thermoid" Non-Skid, Red Tubes

Ten Broeck Tire Co.,
Louisville, Ky.
Plain, Non-Skid, Gray Tubes

Tyer Rubber Co.,
Andover, Mass.
Plain, Hold-Tite Non-Skid, Gray Tubes, Red Tubes, Heavy Gray Tubes, Heavy Red Tubes

U. & G. Rubber Mfg. Co.,
Trenton, N. J.
Plain, Non-Skid, Gray Tubes, Red Tubes

United States Rubber Mfg. Co.,
New York, N. Y.
Plain, USCO Non-Skid, Chain Non-Skid, Nobby Non-Skid, Royal Cord Non-Skid, Gray Tubes, Red Tubes

Universal Rubber Co.,
Philadelphia, Pa.
Plain, Non-Skid, Gripwell Gray Tubes, Red Tubes

Victor Rubber Co.,
Springfield, O.
Plain, Ribbed, Non-Skid, Victor Gray Tubes, Victor Red Tubes, Springfield Tubes, Springfield Red Tubes

Voorhees Rubber Mfg. Co.,
Jersey City, N. J.
Model Gray Tubes, Ideal Red Tubes

Vulcan Rubber Co.,
Erie, Pa.
Red and Gray Tubes only

Vulcanize Products Co.,
Muskegon, Mich.
Plain and Non-Skid Tires, Red and Gray Tubes

Woodworth Mfg. Co.,
Niagara Falls, N. Y.
Plain, Non-Skid, Tubes

Wilson Tire & Rubber Co.,
Springfield, Ill.
Wearwell Plain, Wearwell Non-Skid, Wearwell Gray Tubes, Wearwell Red Tubes, Wilson Non-Skid, Wilson Gray Tubes, Wilson Red Tubes

Zee Zee Rubber Co.,
Yardville, N. J.
Plain, Non-Skid, Tubes

INDEX

PAGE

Abbott tire equipment 170
Adjuster's work 158
Adjustment and sales record 107
Adjustments, Tire 135
Advertise, What, when and how to 131
Advertising angles 129
African grass vines, Extracting rubber from 17
Air, Wasting dollars and saving 141
Allen tire equipment 171
Analyzing tire costs 74
Anderson tire equipment 171
Apperson tire equipment 171
Arbenz tire equipment 171
Asclepias sap contains properties of low grade rubber 14
Auburn tire equipment 171
Austin tire equipment 171
Automobile, registration 10
registration and population 204
success, Pneumatic tires a factor in 28

Balance, Definition of 59
Balanced tires 96
Bead assembly 53
trouble and rim cutting 154
Bent rims 156
Biddle tire equipment 172
Bour-Davis tire equipment 172
Brake skidding 151
Breaker strip and cushion 48
Brewster tire equipment 172
Briscoe tire equipment 172
Buick tire equipment 172
Bush tire equipment 172

Cadillac tire equipment 172

PAGE
Calendering rubber fabric ... 46
Campbell tire equipment ... 172
Car and truck registration in U. S. in 1916 ... 201
registration and population ... 201
tracks or ruts, Driving in ... 152
Case tire equipment ... 172
Cash discounts, Dealer's ... 102
Ceylon mats ... 44
Chain binding ... 151
Chalmers tire equipment ... 173
Chandler tire equipment ... 173
Changes in tire types and sizes ... 40
Channel or herringbone method of tapping trees ... 22
Chevrolet tire equipment ... 173
Coagulating the sap ... 23
Cole tire equipment ... 173
Commercial possibilities of window display ... 114
Commonwealth tire equipment ... 173
Competition, Sizing up ... 109
Compounding and mixing rubber ... 45
drugs with rubber ... 15
Cord tires ... 61
Cost items in finished tires ... 75
Counterfeit rubber, Failure of attempts to ... 24
Crawford tire equipment ... 173
Crow-Elkhart tire equipment ... 173
Cultivated and wild rubber, Production of ... 28
or plantation rubber ... 18
Cunningham tire equipment ... 173

Daniels tire equipment ... 174
Davis tire equipment ... 174
Dealer's cash discounts ... 102
dictionary ... 162
garages, machine shops and supply houses in U. S. ... 206
Detroit (Elect.) tire equipment ... 174
Detroiter tire equipment ... 174
Dispatch tire equipment ... 174
Dixie Flyer tire equipment ... 174
Dodge Bros'. tire equipment ... 174
Dollars, Saving air and wasting ... 141

PAGE
Dorris tire equipment 174
Dort tire equipment 174
Driving in ruts or car tracks 152
Drugs, Compounding with rubber 15

Economy tire equipment 175
Elcar tire equipment 175
Elgin tire equipment 175
Empire tire equipment 175
Erie tire equipment 175
Fabric cutting 47
plies 48
tires 61

Fallacy of price limits 84
Faulty wheel alignment 147
Fiat tire equipment 175
Fluctuations in tire prices and schedules 77
Ford owner, Selling tires to 128
tire equipment 176
F R P tire equipment 175
Franklin tire equipment 175

Garages and machine shops in the U. S. 203
Ghent tire equipment 176
Glide tire equipment 176
Goodyear's early experiments with rubber 42
Grant tire equipment 176
Graph, National car and truck registration, 1911-17 10
Relative changes in consumer tire prices and cost of labor and material 77
Gross and net profits 93

H. A. L. tire equipment 176
Halladay tire equipment 176
Hand and machine made tires 60
Harroun tire equipment 176
Harvard tire equipment 176
Hatfield tire equipment 176
Haynes tire equipment 176
Hevea tree, Drawing sap from ..... [illegible]
Herringbone or channel method of tapping trees 73

PAGE
Hollier tire equipment 176
Hudson tire equipment 177
Hupmobile tire equipment..... 177

Improvements in early tire types..... 30
in tire making..... 67
Importance of rubber..... 13
Inside store hints 118
Inter-State tire equipment..... 177

Jackson tire equipment 177
Jeffrey tire equipment..... 177
Jobbers and dealers, Tire..... 97
Jones tire equipment..... 177
Jordan tire equipment..... 177

King tire equipment 178
Kissel tire equipment..... 178
Kline tire equipment 178
Knowledge required for tire examination..... 136

Laminated tread, Preparing..... 53
Lexington tire equipment..... 178
Liberty tire equipment..... 178
Locomobile tire equipment 178
Low grade rubber, Asclepias sap contains properties of..... 14
Lozier tire equipment 179
Lyons-Knight tire equipment..... 179

Machine and hand made tires..... 60
shops and garages in the U. S..... 203
Machines, Tire building..... 61
McFarlan tire equipment..... 179
Mailing lists 106
lists, Obtaining results from..... 124
Manufacturing angles and slants 59
Manufacturing differences 59
mileage 42
Marion-Handley tire equipment 179
Marmon tire equipment..... 179
Materials in gross weight of tire, Distribution of..... 75
Maxwell tire equipment 179

PAGE
Merchandising tires for profit 81
Metallic oxides and sulphites, Rubber blended with 14
Metric sizes and equivalents, ble 41
Metz tire equipment 180
Mexican Guayule shrub bark 17
Mitchell tire equipment 180
Moline-Knight tire equipment 180
Monitor tire equipment 180
Monroe tire equipment 180
Moon tire equipment 180
Moore tire equipment 181
Murray tire equipment 181

Nash tire equipment 181
National tire equipment 181
Neglected tire cuts 149
Nelson tire equipment 181
Net and gross profits 93
Non-skid tires 64
Non-skid tires, Raised and depressed 68–71
Notes on ordering tires 201

Oakland tire equipment 181
Obtaining results from mailing lists 124
Ohio (Elect.) tire equipment 182
Oldsmobile tire equipment 181
Olympian tire equipment 182
Overhead expenses 92
Overland tire equipment 182
"Oversize" tire formula 36
Owen Magnetic tire equipment 182

Packard tire equipment 182
Paige tire equipment 182
Pan-American tire equipment 182
Para biscuits 44
rubber 17
Partin-Palmer tire equipment 183
Paterson tire equipment 182
Pathfinder tire equipment 183
Peerless tire equipment 183

PAGE
Pennsy tire equipment 183
Percentages of Clincher, QDC and Straight Side types of tires made in U. S..... 201
Phianna tire equipment 183
Pierce-Arrow tire equipment..... 183
Pilgrim tire equipment 183
Pilot tire equipment..... 184
Plantation development 18
or cultivated rubber 18
Pneumatic and solid tires..... 30
tire and tube manufacturers in U. S. 207
tires a factor in automobile success..... 28
Population, Automobile registration and..... 204
Premier tire equipment..... 184
Price factor in making sales..... 122
limits, Fallacy of..... 84
tags 120
Princess tire equipment..... 184
Profits, Protecting 84
Profits vs. Quality..... 82
What tire, is 86
Protection against unfair competition..... 86
Pullman tire equipment..... 184
Pure rubber without tempering ingredients of no commercial value 14

Quality vs. Profit..... 82

Raised and depressed non-skid tires..... 68–71
Rauch & Lang (Elect.) tire equipment..... 184
Regal tire equipment 184
Registration, Automobile 10
of cars and trucks in U. S. in 1916..... 203
Reo tire equipment 184
Revere tire equipment..... 185
Rim cutting and bead trouble..... 154
Rims, Different types of tire..... 31
Roamer tire equipment..... 184
Ross tire equipment..... 185
Rubber blended with metallic oxides and sulphites..... 14
Compounding and mixing..... 45

Rubber, PAGE
Compounding drugs with ... 15
Cultivated or plantation ... 18
fabric, Calendering ... 46
Failure of attempts to counterfeit ... 24
from African grass vines ... 17
Goodyear's early experiments with ... 42
Importance of ... 13
Para ... 17
producing countries ... 19
Production of cultivated and wild ... 28
Pure, without tempering ingredients of no commercial value ... 14
substitute for sole leather ... 27
Synthetic ... 25
tapping, Channel or herringbone method ... 22
tapping, Spiral method ... 23
Washing ... 43
Wild ... 16
World supply ahead of demand ... 26

Sales and adjustment record ... 107
Price a factor in making ... 122
Sap, Coagulating the, ... 23
Drawing from Hevea tree ... 16
Saxon tire equipment ... 185
Scripps-Booth tire equipment ... 185
Seconds or "gyp" tires ... 93
Seneca tire equipment ... 185
Sermon on tire profits ... 87
Sidewalk service facilities ... 115
Silent salesman ... 119
Simplex tire equipment ... 185
Singer tire equipment ... 185
Sizing up competition ... 109
Skid preventer, Suction principle efficient ... 73
Society of Automobile Engineers ... 35
Sole leather, Rubber a substitute for ... 27
Solid and pneumatic tires ... 30
Spiral method of rubber tapping ... 23
Standardizing tire sizes and types ... 35
Standard tire equipment ... 185

PAGE
Stanley Steamer tire equipment 185
States tire equipment 185
Statistics, and how to use them 169
Stearns tire equipment 186
Stephens tire equipment 186
Stone bruise 144
Store front, Appearance 113
hints, Inside 118
Strip and cushion, Breaker 48
Studebaker tire equipment 186
Stutz tire equipment 186
Successful tire selling 106
Suction principle an efficient skid preventer 73
Supply houses and dealers in the U. S. 203
Synthetic rubber 25

Table of metric sizes and their equivalents 41
Tables:
Tire equipment specifications for principal makes of pleasure cars 170
Index of tire sizes 188
Approximate percentages of Clincher, QDC and straight side types to number of tires made in 1916 201
Car and truck registration in U. S. in 1916 203
Registration and population 204
Dealers, garages, machine shops and supply houses in U. S. 206
Tables and statistics, Valuable 169
Tagging tires for stock 100
Tapping, Spiral method 23
trees, V-shaped method 21
Three methods of vulcanizing tires 54
Tire adjustments 135
and tube manufacturers in U. S. 207
assembly 51
building machines 61
costs, Analyzing 74
cuts, Neglected 149
Distribution of materials in gross weight of 75
equipment specifications for principal makes of pleasure cars 170

Tire PAGE
equipment tables 170
examination, Knowledge required for..... 136
guarantees 157
jobbers and dealers 97
"lingo" 162
making, Improvements in..... 67
marketing methods 105
mileage costs 98
molds 51
morgue 193
"Oversize," formula 36
Price schedules, Fluctuations in 77
profit, What it is..... 86
profits, Live sermon on..... 87
rim fundamentals 30
rims, Different types of..... 31
selling, Successful 106
service, How to give it..... 131
sizes, Index of 170
stock keeping 99
stone bruises 144
tags for stock 100
types and sizes, Changes in..... 40
types, Improvements in early..... 30
waste in 1916..... 139
Tires, Balanced 96
Best selling sizes..... 39
Cost items in finished 75
Effect of underinflation..... 144
for profit, Merchandising..... 81
Hand and machine made..... 60
Non-skid 64
notes on ordering..... 201
Raised and depressed non-skid..... 68–71
Seconds or "gyp" 93
Selling, to Ford owner..... 128
Standardizing sizes and types..... 35
Three methods of vulcanizing..... 54
Trade terms 162
Tread compound 15
Preparing laminated 53

MAR 21 1919

PAGE
Tubing machine 58

Underinflation of tires, Effect of 144
Unfair competition, Protection against 86

Valuable tables and statistics 169
Velie tire equipment 186
V-shaped method of tapping trees 21
Vulcanizing tires, Three methods of 54

Washing rubber 43
Wheel alignment, Faulty 147
White tire equipment 187
"Who's who" in tiredom 207
Wild rubber 16
Willys-Knight tire equipment 187
Window display, Commercial possibilities of 114
Winter business 127
Winton tire equipment 187
Woods tire equipment 187
World supply of rubber ahead of demand 26

Yale tire equipment 187